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SYMPATHECTOMY IN THE TREATMENT OF SPASTIC PARALYSIS*

By HERBERT E. COE, M. D., Seattle, Wash.

Reprint from Northwest Medicine, October, 1925

Due to the work of Royle and Hunter of Australia, there has been, during the past year, a marked revival of interest in the treatment of spastic paralysis. This is termed a revival because of the fact that a review of the literature shows recurring periods of activity in the treatment of this condition, following the publication of each newly developed idea as to cause or treatment. The work of Forster and Stoffel dealt with the peripheral nerves. Sharpe worked upon the type of case due to meningeal hemorrhage, and many others have contributed to our knowledge of muscle reeducation and relief of contractures.

The Australian contribution relates to the function of the sympathetic nervous system, and the effect of sympathectomy upon one of the components of spasticity which is present in certain types of this condition. Royle, an eminent orthopedic surgeon of Sidney, has for several years been carrying on experimental work upon the mechanism of spastic paralysis. In common with most other investigators he worked, first, upon the principle of reciprocal innervation, that is, the principle that each stimulus to a muscle group carries with it a reflex impulse which relaxes the antagonistic muscle group. It was also generally considered that the stiffness or increased tone of spastic muscles was maintained by impulses arising in the spastic limb itself, known as proprioceptive impulses.

Royle's experiments demonstrated that reciprocal innervation was not effective in spastic paralysis and led him to study the possible relation of the sympathetic nervous system to the phenomena exhibited by spastic muscles. During this study the late Professor John I. Hunter, who was closely associated with him in these investigations, happened to mention some microscopic slides which showed the endings upon striated muscle of both medullated and nonmedullated nerve fibres. This suggested to them investigations which have resulted in correlating two lines of research that hitherto have been pursued independently by many anatomists and physiologists in various laboratories throughout the world. This correlation is a most significant contribution, and is of such moment that a brief statement of it is warranted even in a clinical meeting such as this.

The first of these two independent lines of research dealt with the type of nerve endings in striated muscle. For many years the existence of two types of motor endings has been recognized and the function and structure of these have been debated from all angles,

*Read before the North Pacific Pediatric Society, Portland, Ore., June 29, and the Forty-seventh Annual Meeting of Medical Association of Montana, Lewistown, Mont., July 8-9, 1925.

until at present most of the investigators are in accord and their decision may be quoted as follows: "Voluntary muscle has a double nerve supply, composed of medullated fibres from the anterior horn of the cord and of nonmedullated fibres from the sympathetic ganglia."

The second line of research dealt with the physiologic activity of muscle, and this also has been under investigation for many years. The concept of a muscle familiar to most of us pictures an elastic contractile body, having an origin and insertion which may be approximated in response to stimuli and thus produce motion. Relaxation of antagonistic groups permits this motion, and since the fibres do not possess the power of active elongation, elongation of a muscle is dependent upon the contraction of its antagonists. Also the property of muscle which maintains it in a state of very slight tension ready to respond to a stimulus is familiar to us under the term of muscle tone or tonus.

Physiologists, however, through their researches have shown muscle activities to be far from the above simple conception. They analyze tone into two components, contractile and plastic; the former being the property by virtue of which muscle fibres assume a diminished length, and the latter the property by which an altered length is maintained. Also, they have shown that the maintenance of the altered length is entirely independent of the property of contractile tone and of voluntary effort. Thus, various postures of the body are assumed and varied reflexly or voluntarily by virtue of contractile tone and these postures are maintained without the expenditure of voluntary effort by virtue of plastic tone.

Further, studies have been carried out to determine the parts played by cortical and spinal control, and by these researches other properties have been discovered. When cerebral control is abolished, a peripheral stimulus causes marked reflex contraction, particularly of the antigravity muscles, or else those muscles concerned in the reflex position of rest of the animal under consideration, which contraction is maintained for a comparatively long period without apparent fatigue. This reflex posture can be changed by external force so as to lengthen or shorten the muscles concerned, and the newly imposed position is also maintained in a like manner.

The term "lengthening and shortening reaction" has been applied to this phenomenon, and it is dependent upon a marked increase of plastic tone caused by the interruption of cortical control. This reaction makes plain the origin of the term "plastic tone" because it is by virtue of this characteristic that the muscle remains for some time in any position assumed and hence resembles a plastic substance.

Further investigations developed the fact that, in a subject showing the lengthening and shortening reaction, section of the posterior nerve roots abolished this reaction, and that, while contralateral

stimuli still produced the increased reflex contraction caused by lack of cortical control, the increase of plastic tone which had served to maintain the position of contraction was lost. This clearly indicated that plastic tone was dependent upon an intact reflex arc, but the exact pathway was still undetermined.

To summarize, then, one line of research had proven the existence of a somatic and a sympathetic innervation of striated muscle, and the other had demonstrated the two components of muscle tone, contractile and plastic, the former concerned with the production and the latter with the maintenance of posture, and had shown that in the presence of a condition simulating spastic paralysis one component could be affected independently of the other. At this juncture, the experimental work of Royle and Hunter took the center of the stage. They saw the possibility of a relation between the two types of innervation and the two types of tone and began extensive experiments upon the relation of the sympathetic nervous system to muscle activity.

A considerable amount of work along this line had previously been done by various observers, but the results had been inconstant and inconclusive; one investigator even stating after reviewing all obtainable evidence, that the only reason for supposing that the sympathetic fibres may have any function at all is the fact that they exist.

Most of this work has been done upon cats and Royle repeated it, using the rabbit, but with the same variable findings. He then determined to use a larger animal, because the sympathetic trunk and its branches would be more definite and the disturbance due to surgery proportionately less. For his subsequent work he used goats, while Hunter carried on additional researches upon fowls. The result of this series of experiments was the demonstration of a constant and consistent influence of the sympathetic nervous system upon the activity of striated muscle.

Without repeating the details of the work it may be summarized as follows: It was shown, first, that simple sympathectomy had no effect upon muscle control, but did destroy the ability to maintain posture without fatigue and caused some depression of reflex activity; second, that the spasticity resulting from section of the cord was definitely altered by sympathectomy, there being inability to maintain posture, no noticeable effect upon reflex response to stimuli, and of course no cortical control or inhibition; third, that the spasticity resulting from decerebration which is characterized by increased plastic tone and the presence of the lengthening and shortening reaction was most markedly affected by sympathectomy, there being almost complete absence of the lengthening and shortening reaction, and the limbs offering little resistance to passive change of motion, thus indicating the removal of the increased plastic tone, there being also a

diminution in reflex activity, and in the continued maintenance of posture, but no appreciable effect upon the rigidity produced temporarily in response to stimuli.

These experiments were performed, recorded and interpreted in a most accurate and comprehensive manner, and form an undeniably sound basis for clinical investigation. In this connection it may be mentioned that a group of reliable men in Chicago, including Kanavel, Pollock and Davis, repeated part of this experimental work under most carefully controlled conditions, using cats for their observations, and they obtained the same inconstant and inconclusive results as Royle in his work upon small animals. They have as yet made no report of work upon larger animals but their reports of clinical cases indicate results somewhat similar to those of Royle, but in general less striking.

How, now, may these experimental findings be applied to clinical conditions, bearing in mind always the difference between the experimental animals and man, and the fact that it has not been possible to reproduce exactly in these animals the complete picture of those diseases which in man are characterized by spasticity.

Spasticity occurs as a symptom in both intracranial and cord lesions, which conditions may be due to either congenital or acquired causes. In the case of congenital intracranial lesions the familiar conditions are atresia of some portion of the brain, or congenital vascular lesions; while as examples of acquired conditions may be mentioned intracranial hemorrhage at birth, traumatic lesions, and the development of vascular abnormalities, such as marked varicosities or hemorrhages from atheromatous arteries. Typical of cord conditions are the scleroses and lesions due to trauma.

Little's disease, as originally described by Little, is due to intracranial hemorrhage from birth trauma but the name is often loosely applied to any condition characterized by a spasticity due to any intracranial condition, occurring in the prenatal, natal or early postnatal period. The characteristic feature of all these conditions is spasticity, due to the release of the spinal centers from the normal cortical inhibitory control. This release of control allows the excitability of the cord to increase gradually until the reflex spinal mechanism dominates all activities of the involved muscles. This means that both the somatic and the sympathetic reflex arcs are affected and, as the experiments have shown, the former subserves contractile and the latter plastic tone. The lack of control of the somatic arc permits an increased contractile response to sensory stimuli, and the lack of control of the sympathetic arc permits an increase of plastic tone, so that the posture produced by the contractile response is unduly maintained.

The most familiar example of this is the increased knee jerk with the delayed drop of the leg, the jerk being due to increased contractile tone and the delayed drop to increased plastic tone. If suc-

cessive stimuli are given, the step-up reaction is exhibited, due to the fact that the increased plastic tone prevents the relaxation of the quadriceps muscle before a new contractile response is superimposed upon the previous one. In cases where the duration of the cortical lesion has been sufficient, the contractile response may not be confined to the extensor groups but, as in the chronic decerebrate preparation, may involve the flexor groups as well, and we have a rigidity in which the visible response to stimuli is determined by the relative strength of the antagonistic groups. Under these conditions a knee jerk may be apparently normal or even diminished in amplitude, and the presence of increased plastic tone can be demonstrated only by the use of passive motion to elicit the lengthening and shortening reaction. To do this the knee is flexed or extended passively. At first there is a distinct resistance due to the increase of plastic tone. As this is overcome the leg is moved fairly easily to a new position which the increased plastic tone again tends to maintain.

Depending apparently upon the extent of the cortical lesion, the amount of cortical control varies and we find all gradations of spasticity from that which is manifested by a slight clumsiness of certain muscle groups to that which causes a tonic contraction of nearly all the muscles of the body in response to a slight sensory stimulus.

Bearing in mind the experimental proof that the sympathetic system subserves plastic tone and plastic tone only, we may now determine the type of case in which we may hope for improvement following sympathectomy. The first requirement of all, and it is an absolutely essential one, is that there shall be sufficient mentality and sufficient maturity to guarantee sustained and intelligent cooperation in the muscle training and the muscle reeducation which must follow the operation. Without sufficient mentality such cooperation is obviously impossible, and a young child even with normal mentality easily becomes discouraged or tired. An arbitrary age limit of six years has been suggested by Adson and it seems reasonable to assume that below this age the average child will not have the necessary patience and persistence to obtain satisfactory results.

The second requirement is that there shall be an unobstructed pathway between the peripheral nerves and the cortical area which initiates voluntary motor impulses. A subcortical lesion, a cerebellar lesion or a cord lesion may obstruct, or even completely block this pathway. It is impossible for voluntary impulses to pass such a block, the condition so far as the muscular system is concerned is the same as when the mentality required to produce such motor impulses is lacking. In the presence of cerebellar lesions causing incoordination, sympathectomy is contraindicated. Motor impulses from the cortex which have to do with posture and purposive movements are coordinated in the cerebellum and, if this coordinating mechanism is not functioning or is functioning erratically, the mere

removal of increased plastic tone from muscle fibres can have no fundamentally good effect. It is even conceivable that such a procedure might aggravate the incoordination by removing a certain amount of restraint. Cord lesions which interfere with cortical impulses likewise are an obvious contraindication, except in those cases where muscle reeducation is possible through the development of collateral nerve paths and where the process in the cord has been stationary for some time. Conditions such as spasmodic torticollis, tics, etc., which are characterized by intermittent contractions or periods of rigidity, are due to disorders of the medullated nerves or to conditions which are transmitted to the muscles by way of medullated nerves and hence cannot be benefited by sympathectomy. They are conditions which are dependent upon contractile, not plastic tone.

The third requirement is that there shall be no deformity or other physical impediment to voluntary motion. In cases of long duration contractures occur, due to shortened muscles, tendons and ligaments and these must be corrected before sympathectomy. Also in those patients who have never experienced normal muscle control a careful and prolonged course of muscle training and reeducation should precede the operation. In many instances a period of stretching by means of plaster or braces reduces spasticity to such an extent that with careful muscle training sympathectomy becomes, for the time at least, unnecessary.

The fourth and last requirement is that increased plastic tone shall be definitely demonstrable. The test for this consists in the demonstration of the lengthening and shortening reaction by means of passive motion, and by the step-up type of tendon reflex as already described.

The present status of the work on sympathectomy would apparently warrant the statement that it is contraindicated in cases which do not comply with these four requirements and that if it is done on such cases, the results will be disappointing and unsatisfactory.

The operation on the lumbar sympathetic trunk as described by Royle is as follows: An incision from the lower rib to the iliac crest is made at the location of the triangle of Petit and carried forward along the crest about three inches. The plane of cleavage in front of the quadratus lumborum is followed and the peritoneum carrying with it the ureter is retracted forward, exposing the psoas and beyond it the bodies of the vertebrae. On the right side the vena cava is raised and the sympathetic trunk is seen directly beneath it. The rami communicantes passing to the second, third and fourth lumbar nerves are cut, as are also all lateral, posterior and inferior connections below the fourth nerve. All medially directed fibres are preserved, unless an effect upon the viscera is desired. On the left the procedure is the same except that the trunk is more easily approached. Adson has varied this operation by using a median abdominal incision

and be severing the trunk above the glanglion which sends rami to the second lumbar nerve and removing it down to a point below the origin of the rami to the fourth lumbar nerve.

The operation developed by Royle for the cervical region follows the usual approach to the brachial plexus by an incision posterior to the sternomastoid. The omohyoid is retracted downward and it may be necessary to ligate the transversalis colli artery. The roots of the brachial plexus are identified as they emerge from behind the scalenus anticus; this relationship, however, varies. The sympathetic trunk does not appear except at the lower angle of the field, and the rami usually cross or penerate the scalenus anticus, joining the medullated nerves close to the intervertebral foramina. They are difficult to define, especially in the region of the eighth cervical and first thoracic roots, where it is necessary to retract the subclavian artery to obtain adequate exposure. The first thoracic root has also a white ramus which must be preserved, if pupillary changes are to be avoided.

The technical difficulties, the frequent occurrence of anomalous conditions, the delicacy of the tissues involved and the necessity for thorough and accurate work combine to place these operations definitely in the front rank of major surgery.

In considering the clinical results of sympathectomy, a marked diversity of opinion has developed and the profession generally is awaiting the publication of further careful observations by a number of men who are at present working upon these cases. Royle's results, as given in his articles and shown by his moving pictures, are most encouraging, but a number of cases reported from Chicago and Boston have been disappointing. One cannot escape the feeling that perhaps in the first rush of enthusiasm at the possibility of doing something to help these unfortunate patients, some were operated upon who did not comply with the definite requirements already mentioned, or that perhaps the operative procedure varied in some small but essential particulars from that of the originator. This latter, however, would hardly apply to those cases which were operated upon by Royle in this country.

Again, it is to be remembered that the results have varied in different types of animals and a certain degree of variation may occur between the larger experimental animals and the human subject. Physiologists, too, are not in accord as to the function of the sympathetic nervous system, in spite of the consistent results of Royle's experiments.

Attention has been called by some to the intense eagerness of many spastics to try anything which offers promise of improvement, and the consequent possibility of a marked psychic effect from an operation. Others claims that whatever postoperative improvement may have occurred has been due to muscle training and the concen-

tration of the patient's attention upon that phase of the treatment.

In spite of the diversity of opinion as to the cause of the improvement, it is undeniable that improvement has followed sympathectomy. Royle has obtained the best results in cases of gunshot wounds of the cortex in adults. In such cases mental maturity, determination and the complete development of motor sensation and activity before the onset of spasticity are factors which would unquestionably enable the patient to take full advantage of any relaxation due to the operation.

Royle also obtained favorable results in certain cases caused by birth trauma. In all cases which show improvement this consists of a relaxation or relief of tension consequent upon the removal of the increased plastic tone. Reflex activity is reduced, voluntary motion is more easily controlled and there is a marked improvement in balance. Royle reports one case in which constipation had followed the cortical injury and this was completely relieved by section of the visceral branches of the sympathetic trunk. Patients frequently speak of the relief of tension or stiffness within forty-eight hours following operation.

The increased contractile tone due to lack of the normal central control is not affected, and the exaggerated response to motor impulses remains. This causes a peculiarity of gait which has been interpreted by some observers as an indication that no improvement has taken place. It will be noted, however, that the peculiarity is due to rapid and increased contractile response, which is largely under voluntary control and which can be markedly improved by training; and that it is not due to the previous inability to change posture which was not under voluntary control and which was obstructing voluntary movements. In other words, sympathectomy removes a certain component of spasticity which is not subject to voluntary control but leaves unchanged a component which is subject to it, and thus permits greater improvement to result from training than could otherwise be obtained.

Sympathectomy is not a cure for spastic paralysis. Nowhere in the published articles of Royle or Hunter is there to be found a suggestion that it is a cure, or that it is indicated in more than a small proportion of the cases. If the cases for operation are not chosen with a strict adherence to the clearly stated requirements, or if greater relief is expected than will result from removal of the obstruction to relaxation, the outcome is certain to be disappointing, not through any fault of the operation but through its faulty application.

After the operation a careful and systematic course of muscle training is absolutely necessary. This may begin with the teaching of voluntary relaxation of muscle groups, then careful control of simple motions, the avoidance of mental concentration which increases

contractile tone, and then the gradual development of ability to control the more complex motions and to maintain balance. The finer movements of the fingers are complex and it is doubtful if any amount of postoperative muscle training will restore these completely. In suitable cases, however, it seems probable that the relief of stiffness will enable patients to become reasonably self-reliant, which will be a boon not only to the patient but to the family and friends.

This work is so interesting and the factors which enter into it are so numerous and diverse that to do it justice would require a monograph. In this paper it has been possible only to outline briefly the experimental basis, the indications, procedure and apparent effect of sympathectomy as applied to spastic paralysis. It has been necessary to omit details and to condense extensive reports and discussions into single paragraphs. Those interested will find it will worth while to refer to the original articles by Royle and Hunter.

Clinical application of sympathectomy is being carried on in several places in this country and the results will, no doubt, soon begin to appear in the literature. Until such time as the status of this operation is definitely established, the careful clinician will choose his cases with strict adherence to the requirements which seem reasonably well established, and will be most reserved in his prognosis.

One of the greatest benefits of sympathectomy will perhaps be seen in that large proportion of cases which is unsuitable for operation, because of the revival of interest in spastic paralysis and a new realization of the great improvement which may be obtained by the proven methods of muscle training, relief of contractures, peripheral nerve surgery, etc. In the small proportion of cases in which the operation is indicated, it seems reasonable to expect improvement and, as Adson has suggested, we may consider sympathectomy as an additional resource at our disposal which will permit us to obtain a greater improvement in a certain type of case than would otherwise be possible.

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INDICATIONS FOR THE USE OF SINE CURRENTS*

By FREDERICK H. MORSE, M. D., Boston

When the transmission of heat, light, sound or any form of energy is spoken of, the natural interpretation is that it is continuous. Any interruption, interference, or deviation from a continuity of motion or transmission opens up an entirely new proposition, as might be applied to physical actions.

For a long time the medical profession has been impressed with the fact that heat was the one essential, not only for the relief of pain, but for the dissipation and possible cure of the products of injury and disease, where nature has failed to establish restoration of impaired function. Modern devices meet these indications whereby the necessary heat can be carried and directed to a chosen part, modified in a very marked degree, and enhance the value of therapeutic methods.

The constructive effects of some of the forms of light treatment and the destructive action of others, have for a long time been greatly appreciated. The therapeutics of other methods depend upon wave impulses peculiar to their source of origin.

High frequency currents produce heat effects by resistance of the tissue to current flow, and the galvanic current produces its thermal action, plus its physiological and polar action.

Much is being said and written daily on the value of diathermy in medicine.

Use of the galvanic current, which necessarily calls for some knowledge of electro-physics, is being ignored by a large portion of physicians because they have been instructed that it is not necessary and diathermy will take its place.

Those who are familiar with the subject know that this is a fallacy, and that enlightenment is the only cure for this state of mind.

An artist's work is successful according to the accuracy with which he imitates nature. Physiologists understand, and biologists have accurately demonstrated, that nature provides in the vegetable and animal kingdom nourishment to maintain normal nutrition of the living body.

The more accurate the indications for determining what the insufficient element may be, the more definite and scientific is the medication that follows. Again, the more accurately the fruit or vegetable containing the necessary ingredient can be adapted to the requirements of the individual, the quicker the absorption of that essential element, when taken from a vegetable, instead of a medicinal source.

If the absorption of essential food ingredients is taken according

*Read at fifth annual meeting American College Physical Therapy, Chicago, Oct. 22, 1926. Reprinted by the author's permission to Mr. Coughlin.

to nature's plan, sufficiently to maintain and not overstrain the organism, and according to best physiological teachings of regular periods of ingestion, digestion, and absorption, and a corresponding period of rest—nature may recover itself by the above metabolic process; other things being equal, man should live a hundred years.

Modern life, with its many deviations of maintaining existence all the way from unbalanced diet to ill-fitting garments and footwear, has so distorted the original plan that the old phrase of "three score and ten" too often closes the life performance with a practical cessation of mental and physical activity, or actual demise with the majority.

The above summary of undisputable facts does not in any way help the sick, only as a warning that humans, like vegetation, are subject to decay. Also that this degenerative process, barring accidents and acute diseases, comes sooner or later in some part of the body where something has happened to give it a start.

Because of the disappointing effect of many stimulants, and unreliability of many medicines, it behooves us to think seriously upon all means and methods to prolong existence by preventive measures. Life depends upon normal cell activity, and that cell activity varies greatly in different tissues and organs, and should be recognized as the one essential in restoring function. This point may be carried further by saying the underlying law of life itself originates and is perpetuated only through rhythmic impulses or vibrations.

The propriety of utilizing in medicine means for restoring function by the use of many processes, brought before the profession during the last twenty years should, if intelligently appreciated, be a means of prolonging existence, and bringing more comfort to suffering individuals than the whole product of the previous century of discoveries.

Thermo-therapy and photo-therapy constitute heat and light rays of varying magnitude. The X ray for therapeutic applications, because of its shorter wave length, has deeper penetrating power. The vacuum and non-vacuum electrodes excited by high frequency currents provide localized heat limited in its usefulness. Diathermy is made to produce an immense amount of heat localized in diseased areas as desired. Static electricity with its most common and valuable form of application to and over diseased areas, under the usual name wave current, has a special virtue of its own because of its ability to liberate near and distant toxemia and other forms of deleterious material. Last, but from a therapeutic point of view in the writer's opinion the most important, is the direct or commonly called galvanic current.

Characteristics of the modalities mentioned may be produced by any form of mechanism that will permit heat, light or electricity

caused to surge to manifest its beneficial action when applied to the body in a way that will imitate as nearly as possible the well-known physiological action of that part.

When a galvanic current is applied through a portion of the body with moist surface electrodes, up to a point of easy toleration, in a short space of time the electrons will so arrange and re-arrange their positions that a current flow is actually established from the positive to the negative pole. If this current, for instance 25 milliamperes, is applied suddenly the skin resistance will be so great as to not only cause shock and pain, but the contraction at first will actually retard the process of transmission as compared with the same amount of current having been allowed to be turned on gradually.

If the current is suddenly reversed, upleasant shock and muscular spasm will ensue, especially about the negative pole, and the process is much interfered with. This is especially demonstrated in the use of the current, when constantly reversing itself, and whether weak or strong, the same characteristic property is always present. The one object to be attained is frustrated by this current reversal.

The application of a powerful light, the thermo-penetration variety, brought suddenly to the body will have less beneficial effect as compared with its gradual approach. The same applies to high frequency currents, diathermy, static wave current, and even mechanical vibration.

The therapeutic value of wave currents is attributed to mechanical action—exercise of muscle tissues. This is obviously for the purpose of improving local metabolism and restoration of muscle tone. That the restoration of function of a part can be brought about by increased cell activity is an accepted fact, and the various methods used to accomplish results will always have strong advocates.

In exercising an area of impaired muscular fibre, let us try and visualize what happens: If we subject a muscle to the action of a slow rhythmic current, we obtain a contraction which starts slowly and by a gradual effort ends in a most complete contraction of which a muscle is capable. During this contraction the blood is squeezed out, the detritus and the used-up venous blood with its $C.O^2$ is forced out of the muscle. With this slowly swelling contraction no rupture of muscular fibre is possible.

A period of gradual relaxation follows, succeeded by a period of rest. During the rest the muscle absorbs fresh arterial blood in much the same manner as a sponge. It is then in the best possible condition of nutrition to exert its maximum force, when the current again stimulates it to its next contraction. The result is improvement in volume and tone, and the nearer we can approach the physiological action between the electrodes, the more definite and simplified the work will be.

While the sine wave currents are applicable to all parts of the body, this form of therapeutics is especially useful (combined with appropriate dietic care) in intestinal stasis. For many years the profession has believed that the low protein diet was the one essential in the medicinal treatment of intestinal auto intoxication.

Physiologists have proven conclusively that the excess nitrogenous material in the colon is an element to be recognized and combated. They realize the futility of drug cathartics and the harmful effects produced if continued. Mineral oils, combined with exercise of some sort, have become popular. Intestinal antiseptics, all the way from iodine to those of lesser importance, coated to be soluble only in an alkaline menstrum (the intestine), also seem to have a popular place.

The curative action of such drugs as belladonna, nux vomica, quinine, and the like, on the involuntary muscle, is not dependable. It is because of the failure to accomplish our ends in this way that physical treatment is resorted to, aided in well defined area by intelligent X ray findings.

Wave currents are applied in the usual manner by moist electrodes externally or by a moist electrode externally and a metallic electrode internally, as the case demands. The size, position and shape may be adapted in keeping with the object to be accomplished. Knowledge of the proper technic and experience alone can accomplish this.

The diseases and impaired function areas that seem to be especially amenable to rhythmic impulses of the alternating current—sinusoidal—are:

Intestinal stasis, gall bladder infection (without the presence of gall stones) gastroptosis, including rectal prolapsus, rectal and sigmoid distortion.

These conditions offer a great field for the alternating sinusoidal current.

Fifty per cent of the above mentioned conditions require the use of metallic internal electrodes. The rapid alternating surging, sinusoidal current is particularly desirable when using metallic electrodes internally, for muscle exercise, because it has no polarity and consequently will not produce polar effects, burn or cause irritation of the mucous membrane.

711 Boyston Street.

SOME MECHANICAL DEVICES USED IN TEACHING CONVALESCING POLIOMYELITIS CASES TO WALK

By MARIA M. KENNEDY

For the physiotherapist of average strength and build, teaching the heavy, rather helpless child to walk is a real problem, unless she uses some mechanical device to help her. We have resorted to three such assistants, which, though not altogether new in principle, have, with some additions and changes in design, been made to fit our needs and materially aid us in doing something encouragingly constructive with the type of case to which we refer.

For those patients whose lower extremities are very weak, and whose arms are able to offer assistance, parallel bars are first used in beginning walking exercises. We have these bars constructed along two sides of the gymnasium of a suitable height to fit any case.

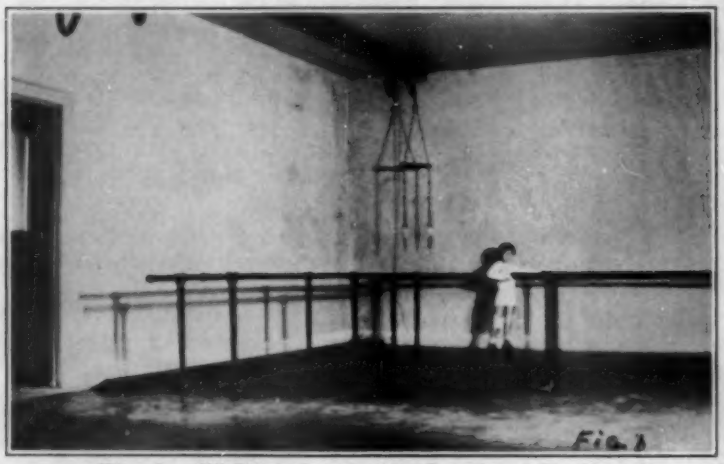


Fig. 1. Walking Bars with Overhead Trolly.

(Fig. 1.) While walking between the bars the patient gains strength and learns to balance, until with time he graduates to crutches.

Such cases as are referred to in the preceding paragraph are not so difficult, but the real problem presents itself with the child, who, in addition to having paralyzed lower extremities, has one or more upper extremities also incapacitated, preventing her being able to exercise alone between the bars. A problem of this type confronting us inspired an attempt on our part to devise some method of saving the physiotherapist's back, and at the same time giving the very lame child a fair amount of walking exercise.

The particular patient (Fig. 2-3), who prompted us to under-

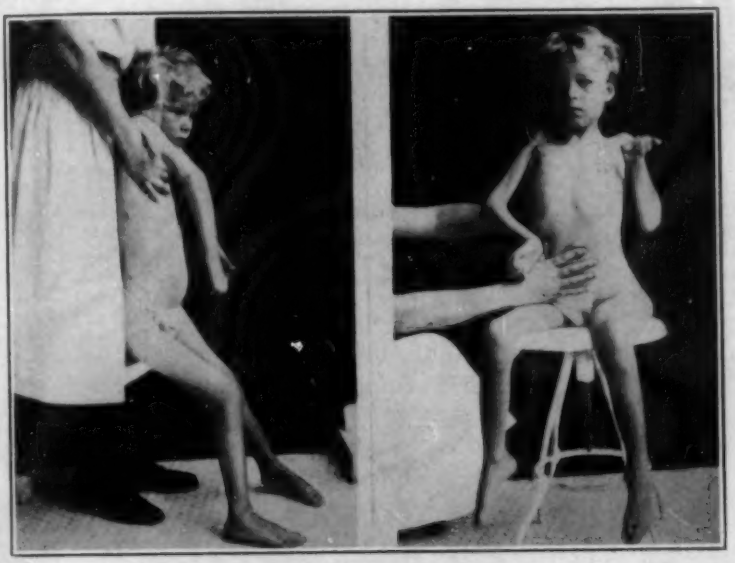


Fig. 2, 3. E. W. Admission Pictures, Showing Arm Raising and Standing Attempts.

take our scheme of management, presented the following muscle picture (Lovett's Test):

MUSCLE CHART

Name—E. W. Date—June 16, 1927. Age 6 years.

	Right	Left
Back Muscles	Fair+	Fair+
Anterior Abdominals	Fair	Fair
Lateral Abdominals	Fair	Fair
Gluteus Maximus	Poor	Trace
Hip Flexors	Fair—	Poor
Hip Abductors	Poor	Fair—
Hip Adductors	Trace	Poor
Inward Rotators	Gone	Fair—
Outward Rotators	Poor	Gone
Tensor Fasciae Latae	Poor	Poor
Quadriceps	Gone	Gone
Inner Hamstring	Gone	Trace
Outer Hamstring	Gone	Trace
Gastrocnemius	Gone	Trace
Anterior Tibial	Gone	Gone
Posterior Tibial	Gone	Trace
Peronei	Gone	Gone
Extensor Longus Digitorum	Gone	Gone
Extensor Proprius Hallucis	Gone	Gone
Flexor Longus Digitorum	Poor	Fair—
Flexor Longus Hallucis	Gone	Fair—
Length of Legs	Same	

	Right	Left
Trapezius	Good	Good
Latissimus Dorsi	Good	Good
Rhomboids	Fair	Good
Serratus Magnus	Good	Good
Deltoid	Gone	Trace
Pectoralis Major	Poor	Poor
Outward Rotators	Poor	Poor
Biceps	Poor	Fair
Triceps	Trace	Trace
Supinator Brevis	Poor	Fair
Pronators	Poor	Poor
Flexor Carpi Radialis	Trace	Trace
Flexor Carpi Ulnaris	Trace	Trace
Extensor Carpi Radialis	Poor	Fair
Extensor Carpi Ulnaris	Poor	Fair
Extensor Communis Digitorum	Gone	Poor
Flexor Profundus Digitorum	Gone	Gone
Flexor Sublimus Digitorum	Gone	Gone
Lumbricales	Gone	Trace
Dorsal Interossei	Gone	Trace
Palmar Interossei	Gone	Trace
Opponens Pollicis	Gone	Gone
Abductor Pollicis	Gone	Poor
Thumb Flexors	Gone	Gone
Thumb Extensors	Gone	Fair+
Abductor, 5th Finger		Poor
Abductor, 5th Finger		Poor

The patient's back and abdominal muscles were fairly strong, and she had some flexion power in the hips, but her hip and knee extensors were either very poor or gone. Her most crippling deformity was the loss of those muscles in the arms and hands, which would aid her in holding crutches. Her heelcords and hip flexors were contracted, which called for operative procedure. Under hospital care, following her recuperation from these operations, the child gained appreciably in weight and general health. This was, of course, to be desired, but when the necessary back and double leg braces were added to her natural weight it was a real task for anyone to help her to walk.

As an aid to the accomplishment of walking we had a trolly track suspended from the ceiling over one section of our walking bars. From the trolly, running on this track, we dropped two ropes, held apart by a wooden cross-piece, and terminating in iron rings, through which the shoulder straps of the child's brace could be fastened. This sustained the excess weight and held her in an upright position. With a pulley mounted at one end of the track through which a long rope was passed with its two ends fastened together on the trolly, the physiotherapist was enabled to stand at the opposite end of the track, and by pulling on the middle section of the rope, help the patient to walk and at the same time save herself the strain of carrying a ninety-pound child. (Fig. 4.)

Fig. 4. E. W. Walking with the Help of the Overhead Trolly.

For the average gymnasium period this apparatus sufficed, but the patient required more walking exercise if she made the desired progress, so we resorted to an apparatus resembling an oversize baby-walker. This was made of ¼ inch pipe, mounted on the best ball bearing rollers obtainable. The child was supported in this by six buckle straps—two for suspension purposes, hitched from the sides of her pelvic band to the top bars of the walker; two from the same origin to the two front supporting bars; and two more from her shoulder brace to the back of the walker for trunk support. (Fig. 5.) It was a little tedious to get her into this, but once in, she could stay all day, getting out for the afternoon rest period only. The apparatus moved with the least possible pressure. The child was unable to help herself at first, but by dint of the utmost effort and perseverance, she learned to make those muscles at her command give the walker the needed momentum, and now travels where she wishes on the level floor or walkway. The walker has attached on the front a tray to be used for arm support. On this tray the patient does her school work, writing with a pencil held in her mouth. The same support serves as a table for her meals.

With massage, corrective exercises on the table and in the warm

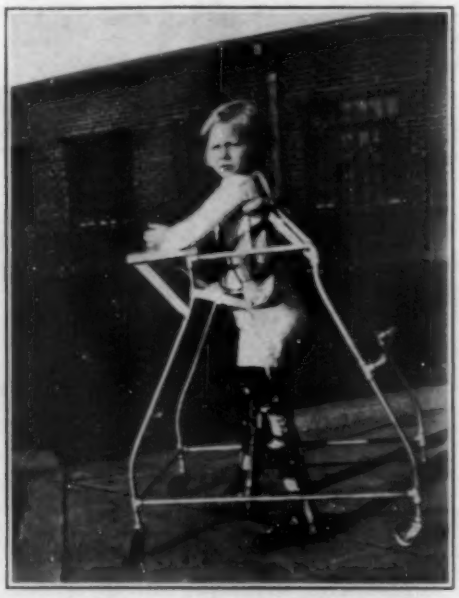


Fig. 5. E. W. Strapped in Her Walker.

water swimming pool, and much walking, the patient's muscles have made encouraging gain in strength. (See muscle test below.)

MUSCLE CHART

Name—E. W. Date—Jan. 28, 1929. Age—8 years.

	Right	Left
Back Muscles	Good	Good
Anterior Abdominals	Good	Good
Lateral Abdominals	Good	Good
Gluteus Maximus	Fair—	Fair—
Hip Flexors	Fair—	Fair
Hip Abductors	Poor	Fair
Hip Adductors	Trace	Poor
Inward Rotators	Gone	Fair—
Outward Rotators	Poor	Poor
Tensor Fasciae Latae	Poor	Poor
Quadriceps	Gone	Poor
Inner Hamstring	Gone	Poor
Outer Hamstring	Gone	Poor
Gastrocnemius	Gone	Poor
Anterior Tibial	Gone	Trace
Posterior Tibial	Gone	Trace
Peronei	Gone	Gone
Extensor Longus Digitorum	Gone	Gone
Extensor Proprius Hallucis	Gone	Gone

	Right	Left
Flexor Longus Digitorum	Poor	Fair
Flexor Longus Hallucis	Gone	Fair
Length of Legs	Same	
Trapezius	Good	Good
Latissimus Dorsi	Good	Good
Rhomboids	Good	Good
Serratus Magnus	Good	Good
Deltoid	Trace	Trace
Pectoralis Major	Poor	Fair—
Outward Rotators	Poor	Fair
Biceps	Poor	Fair+
Triceps	Poor	Poor
Supinator Brevis	Poor	Fair
Pronators	Poor	Fair
Flexor Carpi Radialis	Trace	Trace
Flexor Carpi Ulnaris	Trace	Fair+
Extensor Carpi Radialis	Fair+	Fair+
Extensor Carpi Ulnaris	Fair+	Fair+
Extensor Communis Digitorum	Gone	Poor
Flexor Profundus Digitorum	Gone	Trace
Flexor Sublimus Digitorum	Gone	Gone
Lumbricales	Gone	Fair—
Dorsal Interossei	Gone	Fair—
Palmar Interossei	Gone	Fair—
Opponens Pollicis	Gone	Gone
Abductor Pollicis	Poor	Fair
Thumb Flexors	Gone	Gone
Thumb Extensors	Gone	Good
Abductor, 5th Finger	Gone	Fair+
Adductor, 5th Finger	Gone	Fair+

No pieces of apparatus in our gymnasium are given harder usage than our walking devices—walking devices for the patients but back-savers for the physiotherapist.

North Carolina Orthopedic Hospital, Gastonia, N. C.

INFANTILE PARALYSIS WORK IN THE RHODE ISLAND HOSPITAL, PROVIDENCE

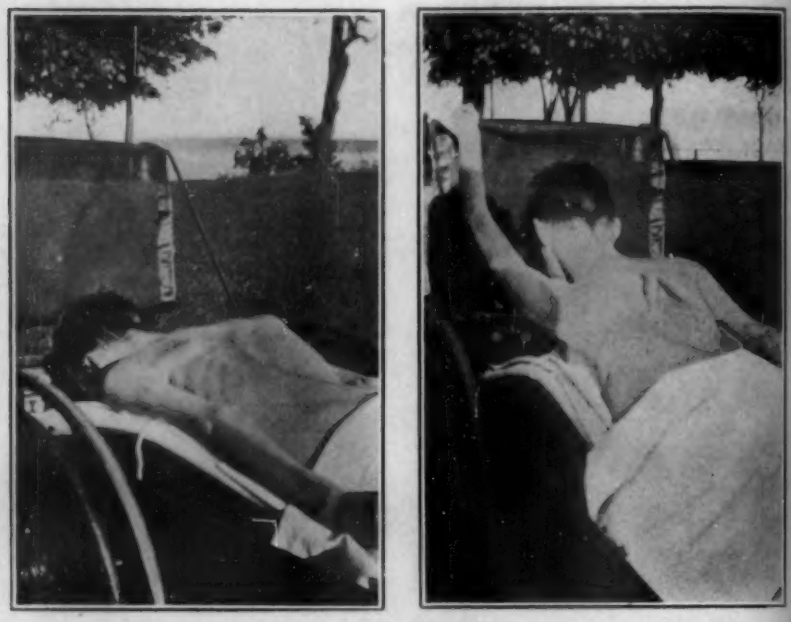
By DOROTHY HISLOP

In 1923 a special clinic was commenced in the Rhode Island Hospital for the care of infantile paralysis cases. Previous to that time such cases were treated in the orthopaedic clinic, but extensive epidemics in 1922 and 1923 brought such an increase in the numbers of these cases that it became necessary to form a special clinic. At first the work was confined to recent cases, but soon all infantile paralysis cases treated by the hospital were centralized in this clinic. These were all outdoor patients, and very soon the greatest difficulty was their transport. Mothers felt the strain of bringing in their children from outlying parts of the city in all weathers and although several interested friends of the hospital gave the use of their cars the transport remained the outstanding difficulty. About a year after the founding of the clinic a car was presented to the hospital for the use of the clinic, and the generous donor still continues to keep up its running expenses. This car starts out in the early morning and picks up the patients at their homes and brings in a car load of children to the Out-Patient Department of the hospital, where the Physiotherapists are ready to receive them. Then, while these have treatment, the car goes to another section of the city and picks up a second load, brings it in and takes the first home again—then proceeds to still another part of the city, and so on. Meanwhile the Special School for Crippled Children has sent in their motor bus with their infantile paralysis cases, and by the middle of the morning the clinic room becomes a fairly lively place. Most of the patients are referred to the clinic straight from the city hospital, where such cases are treated in their acute stage, and at first the mother or some responsible person is brought in with the child so that when possible they may be taught all that can be done for the child in the home. Later the children are allowed to come in alone in the care of an experienced hospital orderly in order that the greatest number possible can be brought in in one day.

This clinic is held three mornings in the week, and the orthopaedic specialist in charge visits the patients under treatment there once in two weeks. There is an orthopaedic workshop in the Out-Patient Department where all braces for these patients are made and repaired. This adds very greatly to the efficiency of the care of the children, as immediate repair of a damaged brace, so that the patient need never go so much as one day with a limb or back unsupported, seems one of the most important features in the treatment of anterior poliomyelitis.

As for the general treatment of these cases—heat for increased circulation, massage and careful reeducation of muscle, combined

Three of the Patients at Crawford Allen Memorial Hospital.



A Scoliosis Case also Treated in Salt Water.

with general postural exercises where such are indicated, is all that is aimed at in the clinic at the hospital.

The Rhode Island Hospital has an auxiliary hospital for children known as The Crawford Allen Memorial Hospital, situated on Narragansett Bay about twenty miles from Providence. It has a new and very up-to-date hospital building which was opened a year and a half ago, equipped amongst other things with a salt-water pool. To this auxiliary hospital are sent a certain number of patients from the Infantile Paralysis Clinic. As the number is limited, these cases are chosen from among those with poor home conditions or whose paralysis is fairly extensive and likely to benefit most from salt water treatment.

There they are visited three times a week and given the same treatment as in hospital, with the addition of exercise in salt water. In very warm weather this is taken in the open air in the water of Narragansett Bay, and during the greater part of the year in the pool where the water is pumped from the bay each time and heated to a temperature of about 90°. The exercises given are chosen to develop the especially affected muscles or groups of muscles, using the water as support for the body and as resistance. The complete support of a limb by the water enables the patient to concentrate on the

abduction, adduction, flexion or extension desired, and the resistance of the water is enough to facilitate control of the working muscles, e. g., in walking in the water the muscular work is increased by the resistance of the water but the buoyancy gives enough support to steady the gait of a one-sided paralysis. In a case with two paralyzed deltoids the child has been taught to swim on her back, in the reverse way from the normal, bringing her arms from abduction through the resistance of water to stretch position, and so on.

Cases with scoliosis or a tendency to scoliosis are taught to swim with a one-sided stroke and to stretch in a corrective position in between each stroke.

Abdominal exercises are very much more easily given in the water, and these take the form of rolling, raising from lying position to sitting upright, etc.

After special exercises a short time is allowed for ordinary swimming as a means of general exercise. This, while of a certain physical value, is used more for its effect on the mental attitude of the patient. The child discovers that in spite of two completely paralyzed legs, he or she can swim, float, and feel as thoroughly at home in the water as others less handicapped—and by the time summer comes round and all the inmates of the hospital plunge into the bay it is the infantile paralysis cases who, by dint of their extra practice, are the stars of the swimming world.

Infantile paralysis treatment must of necessity remain one of the slowest and often most discouraging problems in the work of the physiotherapist, but it is felt that Rhode Island is making strides towards brightening the outlook, both from the point of view of the worker and of the patient.

133 Waterman Street, Providence, R. I.

Group of Patients at Crawford Allen Memorial Hospital Awaiting Treatment in Narragansett Bay.

The cut at the upper left shows a patient with double leg paralysis, with walking caliper braces. This patient is now walking fairly easily without crutches, after over a year at Crawford Allen Memorial Hospital. The cuts below show an infantile paralysis case (double deltoid paralysis) at Crawford Allen Memorial Hospital. Patient is wearing leather jacket with two abduction splints attached. Photograph without apparatus shows extent of recovery of both deltoid muscles.

THE USE OF MEDICAL GYMNASTICS IN THE TREATMENT OF CERTAIN ABNORMAL HEART CONDITIONS

By MARY V. FLANNERY, C. S. M. M. G. M. E.

Before discussing the work of the heart under diseased condition, its structure and its normal functions must be briefly considered.

The heart is a hollow, muscular cone-shaped organ situated in the anterior part of the thoracic cavity, in contact with the chest wall, and just behind the sternum and left costal cartilages. It is enclosed in a membranous sac called the pericardium, which consists of two layers: (a) an outer fibrous membrane; (b) an inner serous membrane.

The outer layer is continuous above with the coats of the great vessels, and completely surrounds the heart, blending below with the diaphragm, and thereby helping to keep the heart in position.

The serous membrane is intimately connected with the fibrous layer. It extends to the roots of the great blood vessels above, and lines the fibrous membrane. The serous membrane has two layers: (a) Visceral layer—which is in contact with the surface of the heart: (b) Parietal layer—which is in contact with the outer fibrous membrane of the pericardium. Between these two layers is the pericardial fluid, which serves to keep the membranes moist, and to facilitate the movements of the heart.

The muscular tissue of the heart—or myocardium—is composed of cells, quadrilateral in shape, having a nucleus, and showing faint transverse striations. This cardiac muscle fibre is involuntary though striated. Its bundles of fibres are held together by connective tissue, which also supports numerous blood vessels, lymphatics and nerves. The power of contraction is inherent in the muscle of the heart, but it is influenced by the vagus and sympathetic nerves. Stimulation of the former shows the heart's action; stimulation of the latter produces an accelerating effect.

The interior of the auricles and verticles is lined with endocardium, which forms the perfectly smooth surface inside the heart. A double layer of this endocardium strengthened by fibrous tissue forms the valves. The mitral and tricuspid guard the left and right auriculo-ventricular orifices, and so prevent a return of the blood into the left and right auricles. The semilunar valves, by closing over the orifices of the aorta and pulmonary artery, act as a barrier to the downward passage of the blood from these arteries into the heart.

The blood, which is the nutriment carrier of the body, is contained in a closed set of tubes, which it completely fills. Interposed in this set of tubes is the heart, which, by the contraction of its muscular fibres: (1) forces the venous blood from the right ventricle

into the pulmonary artery; (2) pumps the arterial blood from the left ventricle into the arteries and arterioles of the general circulation.

The right and left auricles, contracting simultaneously, drive the blood into the ventricles. During systole, the ventricles expel the blood from their chambers; during diastole the ventricles dilate.

It is easily understood that any interference with this "cardiac cycle" is bound to influence, to a greater or lesser degree, the general metabolism of the body.

As a sequence to cardiac insufficiency, the abdominal organs become edematous and congested and, in consequence, the retention of waste matter by the tissues produces injurious results not only on the general system but also on the heart itself.

Diseases of the heart may be classified into four main groups:

I. Disease of the heart muscle.
II. Disease of the endocardium.
III. Disease of the pericardium.
IV. Diseases of the nervous mechanism of the heart.

Common to each of the above conditions are certain changes: (a) Alteration of blood pressure in the arteries of the systemic circulation. This causes: (b) Stasis of the blood stream, which results in (c) Disturbance in the general metabolism of the body.

Because of the impaired nutrition, the walls of the capillaries become porous, and the blood serum exudes into the tissues. The lymph spaces become distended, and the exuded fluid exerts a pressure on the outer side of the vessel wall. The pulmonary capillaries, having dilated, press on the alveoli, and prevent their full expansion. Consequently in its passage through the lung tissue, the blood is only partially aërated, and the contents of the pulmonary veins return to the heart containing more CO_2 than normal. To overcome the increased strain, the heart uses its reserve force, but when this fount of energy is exhausted, the symptoms of heart failure are more pronounced. The most common of these are:

(1) Cyanosis—Partly the result of the excess of CO_2 in the blood.

(2) Breathlessness—Because of deficiency of O in the blood and tissues.

(3) Coldness of the extremities—Due to circulatory weakness.

(4) Palpitation—Being strained, the heart, by weaker and more frequent contractions, tries to respond to any demands made on its failing energy.

(5) Changes in the pulse.

(6) Oedema—Starts in the distal parts, i. e., the feet, and spreads upwards. It is caused by the exudation of fluid through the porous vessel wall.

(7) Lassitude—Due to insufficiency of O.

(8) Pain in the region of the heart—May not be a true symptom of heart failure.

GENERAL PRINCIPLES OF HEART TREATMENT

During the period of heart failure no gymnastic treatment is given. At this stage, the main object of treatment is to insure rest. The relief of any distressing symptoms and the conservation of the patient's energy are of prime importance. When, however, compensation commences to return, the heart must be stimulated without increasing its work. For this purpose drugs, as ordered by the physician, are essential. Gentle massage of the limbs, e. g., arm and leg kneadings which begin above and gradually progress to the distal part of the limb, assist the venous return circulation. Chest liftings, and chest lift strokings, plus gentle passive arm movements which progress to raising the arms to shoulder level, help to relieve congestion in the thorax. Further progression is made by letting the patient perform free, active movements, always beginning with the distal joints. Later, joints may be worked simultaneously. Work is determined by the actual number of muscles called into play, and the rate of the exercises is determined by the patient.

In treating heart conditions in which compensation has been established, graduated gymnastics are a very important therapeutic factor. A moderate stimulation of the myocardium results in a more powerful systole. In consequence of this, the congestion in the tissues is relieved, the kidneys and skin help to eliminate waste products, the general metabolism is improved, and the patient's outlook is more optimistic when he realizes that increased muscular work is no longer a strenuous effort.

When definite, active, progressive work can be given, the following graduated schemes of exercises have been most beneficial in producing these results:

Scheme I.—Patient Still in Bed

(1) Half lying. Chest lift stroking. (Three times. Given in time with patient's breathing.)

(2) Half lying. Leg kneading, plus stroking, plus foot bending, plus stretching. (Free—6 times.)

(3) Sitting. Double arm raising to shoulder level. (4 times.)

(4) Crook half lying. Abdominal kneading, plus stroking, plus alternate knee upraising. (3 times.)

(5) Half lying. Abdominal breathing.

(6) Half lying. Arm kneading, plus forearm bending, plus stretching. (Free—three times.)

(7) Half lying. Knee bending, plus stretching.

(8) Half lying. Chest lifting with vibrations.

Rest for Thirty Minutes

Note.—Half lying position is that of a patient in bed whose back rest is in the raised position at an angle of 140 degrees approximately. Crook half lying is the above position with the knees flexed over a pillow or some comfortable support.

Scheme II.—Patient Still in Bed

(1) Half lying. Double arm raising sideways with breathing. (4 times.)

(2) Half lying. Leg kneading, plus stroking, plus leg outstretching. (Free—4 times.)

(3) Sitting. Head extension.

(4) Half lying abdominal breathing, plus abdominal kneading, plus stroking.

(5) Wing sitting. Alternate trunk rotation. (Free—5 times in each direction.)

(6) Half lying. Arm kneading, plus double arm bending, plus stretching. (Free—4 times.)

(7) Half lying. Knee bending, plus stretching. (Free—4 times.)

(8) Half lying. Chest lift shaking.

Rest thirty minutes.

Scheme III.—Patient Up

(1) Half lying. Chest lift shaking.

(2) Walk twenty yards in one minute.

Rest one minute.

(3) Half lying. Double arm bending, plus stretching, using one pound dumb bells. Exercise to be done six times in one minute.

Rest one minute.

(4) High ride sitting—Circle turning.

(5) Wing closed sitting. Alternate trunk rotation. (Four times with resistance.)

(6) High ride sitting. Trunk backward bending.

(7) Standing. Double arm raising to stretch position, plus breathing exercise. (Six times.)

(8) Half lying. Leg rolling, plus leg outstretching.

(9) Sitting chest clapping.

Rest thirty minutes.

According to patient's progress, and in accordance with the doctor's orders, these exercises are gradually progressed so that patient does entirely free gymnastics in which all the muscles of the body are brought into play. This method of treatment is continued until patient can undertake moderate exercise without becoming breathless.

Precautions to be Observed in All Heart Treatments

(1) Pulse rate should be recorded before and after each treat-

ment, and before and after each new exercise that is added to the scheme.

(2) For treatment of chronic heart conditions, the pulse rate may be increased from ten to twenty beats as long as it returns to normal within a rest period of one and one-half minutes.

(3) Exercise must be strong enough to alter the pulse rate, and when possible a known resistance, e. g., dumbells, should be used.

(4) All starting positions and exercises which impede respiration should be avoided.

(5) Care must be taken to avoid breathlessness and palpitation.

(6) Operator watches closely for signs of fatigue.

(7) Any evidence of discomfort during treatment should be reported to the physician in charge.

A scheme for the use of medical gymnastics as an adjunct to the medical treatment of cardiac failure has been outlined. Its rationale and limitations have been described. It has proved to be a definite benefit in the treatment of nearly one hundred cases of cardiac failure.

Mercy Hospital, Pittsburgh, Pa.

COMPENSATION IN THE TREATMENT OF SCOLIOSIS

By BEATRICE WOODCOCK

The treatment of scoliosis has consisted of the attempted correction of the deformed portion of the spine, by the application of direct force of pressure or traction upon the primary curve.

Unfortunately these methods have destroyed the rigidity of the primary curve and accelerated its collapse. According to Dr. Steindler's views, treatment is carried out by development of compensatory curves and with avoidance of forcible measures, which would contribute to the collapsibility of the spine.

For the past eighteen months the writer has had the opportunity of working with Dr. Steindler, using his compensatory method of treatment of scoliosis. The details of this method are given as follows: First and foremost, the impossibility of obtaining an anatomical cure of the primary curve is recognized. The aim is not to correct the primary curve, but to develop compensatory curves above and below.

In an article on scoliosis, Dr. Steindler says, "A spine relaxed by fruitless efforts of correction is forever prone to collapse, but with its rigidity left intact it may become a stable factor in the scheme of natural realignment of the body and spine as a whole. So we must develop counter curves of equal degree and intensity, which will satisfy the demands of statics and maintain body balance. Nothing is done to loosen the rigidity of the primary curve, except as its ends are drawn into compensatory curves.

Creeping Exercise.

Relaxed Position before Shifting.

Derotation is gotten by means of the pelvis. As the pelvis is rotated backward, locking of the lumbar articular processes transmits rotation to the terminal portion of the curve, which, it must be remembered, is not as rigid as the centre of the curve. In this way we get the compensatory, rotatory curves. The compensating lateral bend is established by mobilizing exercises of the lumbar spine.

Before treatment is started a thorough physical examination is made, especially of the heart and lungs.

TREATMENT

(1) A photograph of the spine in the erect and forward bend position.

(2) An X ray on an upright plate 14 inches by 17 inches. The upper rim of the pelvis at the lower edge of the plate.

(3) Weight distribution. To determine the distribution of the body weight, the patient is weighed on double scales. In this way both

sides of the body are weighed, right side and left side, anterior and posterior.

Deviation from the plumb line is recorded at the seventh cervical, twelfth dorsal and mid-sacral. In the anterior and posterior position deviations are noted at the mastoid, acromion and trochanter. Anything above ten per cent difference in the weight of the right and left side of the body may be considered pathological.

(4) Extensibility of the spine. Normal extensibility is 1.8 per cent of the length of the spine. Anything considerably above may be considered pathological.

(5) Respiratory excursion. This is made at the nipple line and the Xiphoid process.

When the record is made the child is ready for intensive gymnastic treatment.

Most of our cases are resident in the hospital and attend gym twice daily for periods of one and one-half hours, with three hours interval for lunch and rest.

Shift Position.

In the gym our efforts are directed towards mobilizing the lumbar spine, building up the general musculature and developing counter curves.

Gym suits are worn, consisting of bloomers and a waist which fastens at the back, so that the back muscles can be closely watched.

The exercises given are symmetrical and asymmetrical, active and passive.

All loosening up exercises are eliminated, such as long-hanging, ladder, travel, etc. We want to loosen the lumbar spine, but not the primary curve.

Below are some of the exercises which we use in this method of treatment.

(1) Creeping. Cover the knees with felt pads and assume the creeping position on hands and knees. Stretch the right arm forward and the right leg backward. At the same time slide the left knee forward. Stretch the left arm forward and the left knee backward

On Scales before Shifting.

and at the same time slide the right knee forward. Creep in a circle and in the direction indicated by the curve. This exercise may be done to music. If taken fairly slowly more stretch is obtained. Five times round the gym is usually sufficient. All cases are allowed to drop out as soon as they feel tired.

(2) Body Shifting. A child with a right curve will be found to carry an excess of weight on that side. He is taught to shift this to the opposite side. Stand erect with feet together. Shift over from the lumbar spine, elevating the low shoulder. This exercise is one of the most difficult to get on to. Once it is grasped it is quite easy. Returned patients have told me that they have walked as far as a block and a half in the shift position.

(3) Rotation of the Pelvis. This is a passive exercise. The patient lies over the edge of the plinth, securely strapped at the thorax. The pelvis is then rotated passively backward and downward.

On Scales Shifting.

Rotation of the pelvis can also be given in the sitting position. A special chair, made by Dr. Greive, is used. The seat of this chair is reversible and one side is higher than the other. The child is strapped in and fastened at the thorax. The seat is then twisted, passively rotating the pelvis.

Passive rotation helps to develop rotatory curves. An active exercise is always given after a passive exercise.

(4) Ring Exercise. Patient lies on the plinth face down. Slip rings over the legs up to the hips and swing hips out in the direction indicated by the curve.

(5) Aeroplane Exercise. This is an active which may be used after a passive exercise. Stand erect with feet apart. Raise arms to shoulder level—trunk turn to ..... raise arm of low shoulder from horizontal to vertical—bend forward and touch..... toes with ..... hand. Raise trunk up—backward turn—arms lower.

Passive Rotation of the Pelvis in Dr. Grieve's Chair.

(6) Spring Sitting. This furnishes another very good active exercise. Sit on the edge of stool with whole length of thigh supported and knee flexed. Bend trunk forward. Stretch arm of low shoulder forward and opposite leg backward.

(7) Rolling. Lie flat on back. Raise ..... arm to vertical—clasp with ..... hand above elbow. Cross..... leg over ..... and roll over.

(8) Head Carrying Exercises. In cases of high dorsal and cervical scoliosis head carrying exercises are given before a mirror. A felt cap with a ring in the centre is tied on the head to one side. A cup half full of water is then placed in the ring. The child then walks toward the mirror.

Walking on the balance beam is also given before a mirror.

As rountine work the class is drilled in dumb-bell exercises for the development of the shoulder girdle. Leg and abdominal exercises are also given in class work. Between exercises the children rest on mats in the prone position.

When compensation is obtained the child is put in a removable plaster cast or an appropriate brace. The disadvantage of an ir-

Passive Rotation on the Plinth.

Aeroplane Exercise.

removable cast is a trophy of the musculature and loss of function from inactivity. The brace includes leg and thigh on the opposite side of the primary curve.

During the entire period of brace wearing the gymnastic work is continued and carried very considerably beyond this. The exercises at this stage, of lasting convalesence, are principally symmetrical.

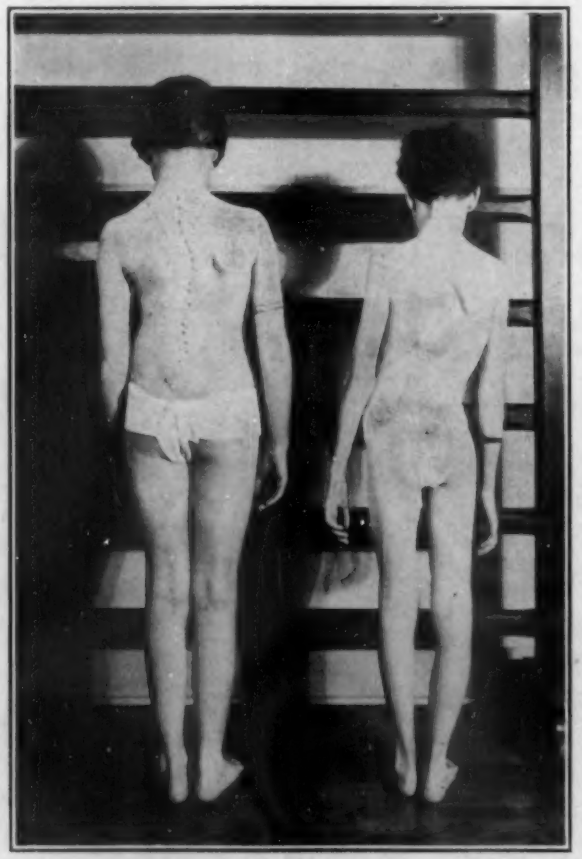
Children's Hospital, Iowa City, Iowa.

AN INTRODUCTION TO THE CHILDREN'S ORTHOPEDIC HOSPITAL, SEATTLE, WASHINGTON

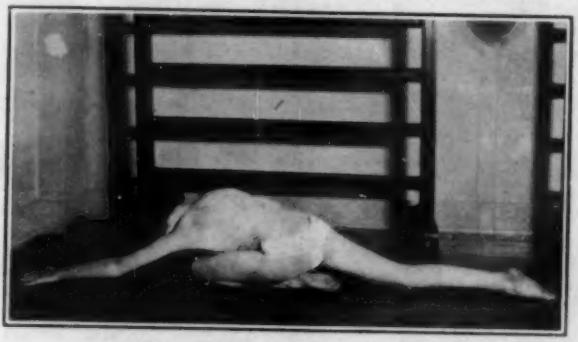
By DORTHEA SORENSON

The Children's Orthopedic Hospital at Seattle was organized in 1907 by twenty-five women, who each contributed twenty dollars and opened a six-bed ward in the Seattle General Hospital. Since that time it has steadily grown until now there is a four story building with a capacity of 150 beds.

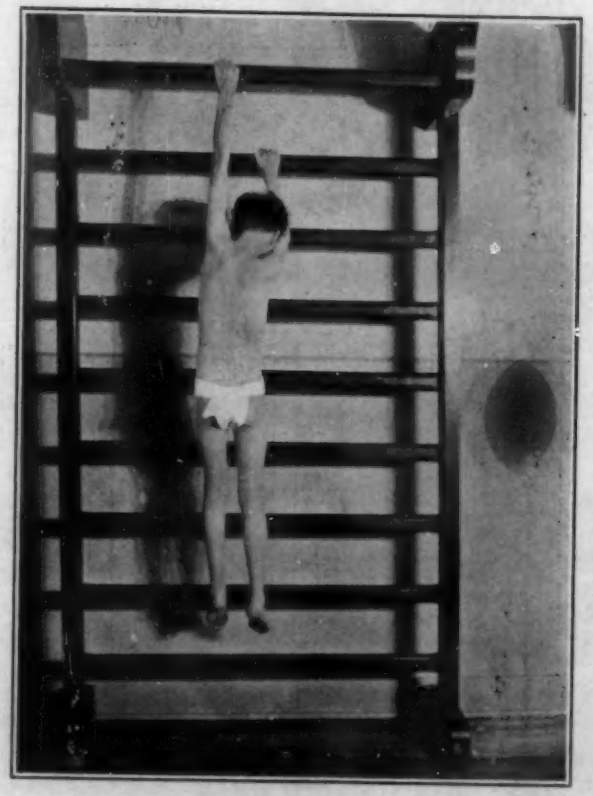
As in the beginning, the support of the institution is entirely by subscription. There now stands an endowment fund of about $250,000, the earnings from which are used in the support of the institution. The main source of income is through the guilds (organ-



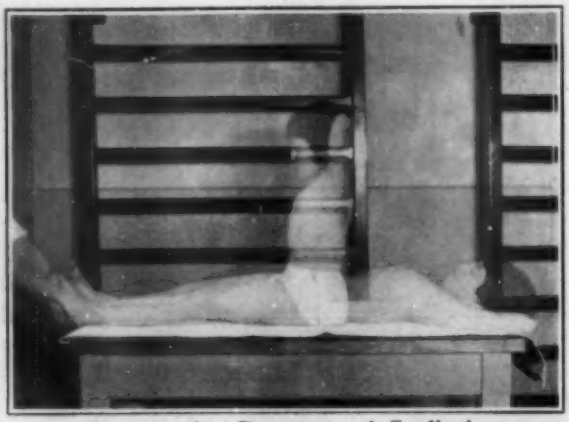
Scoliosis.



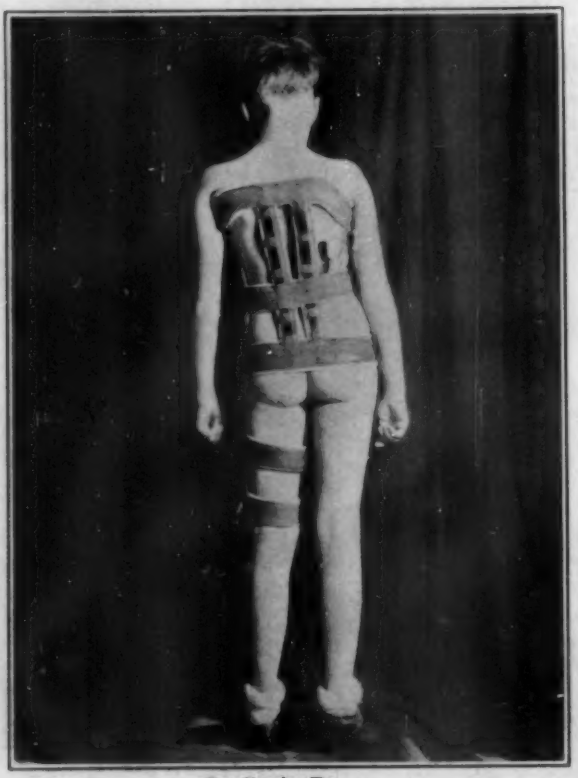
The Crawl for Scoliosis.



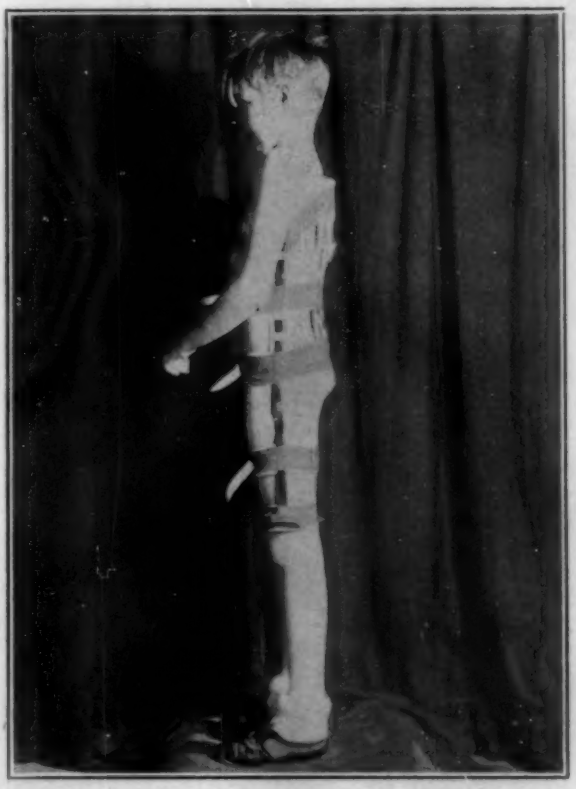
Suspension Exercise for Scoliosis.



Exercise for Posture and Scoliosis.



Scoliosis Brace.



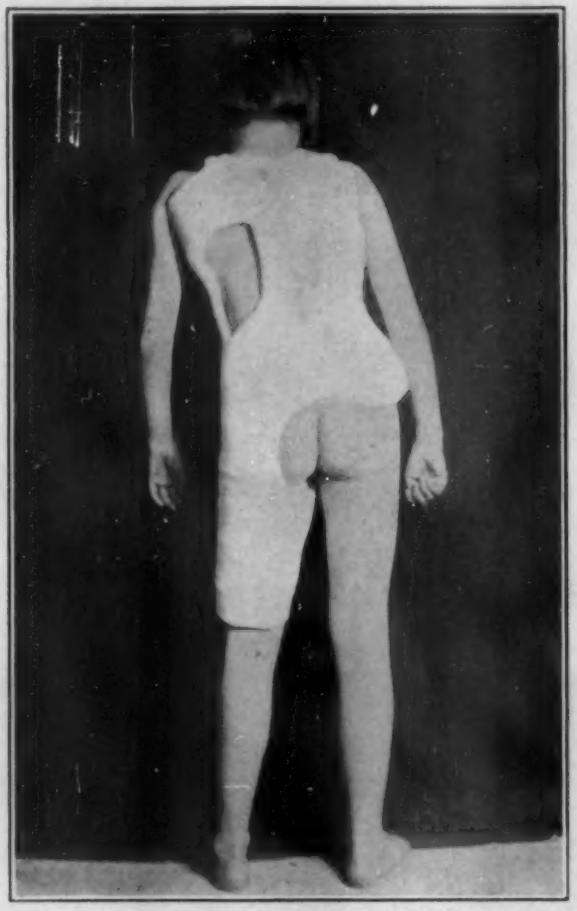
Scoliosis Brace.

ization of members) which produce the income in various ways—cash, food supplies, etc. The guild council, consisting of all past guild presidents, and the board of trustees complete the executive organization.

Though the hospital is orthopedic in main with a staff of forty doctors it is prepared to handle any type of children's disease except the contagious and incurable. The age limit is fourteen. The majority of patients are free or only part pay, though some private cases are cared for when there is room.

It is of interest to know that the Seattle school system provides teachers for all children who are able carry on their school work, even into the high school.

There is also an Occupational Therapy Department which is supported by the hospital and the sales from the article made in this department.



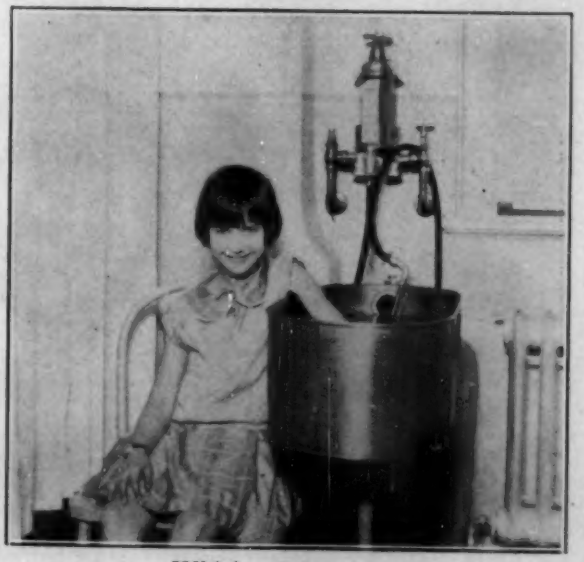
The "Shift-cast."

The Physiotherapy Department consists of one large treatment room equipped with tables, radiant heat bakers, whirlpool baths and a swimming pool. Two other small rooms, one a gymnasium and one for Ultra-Violet treatments and other general treatments, complete the department.

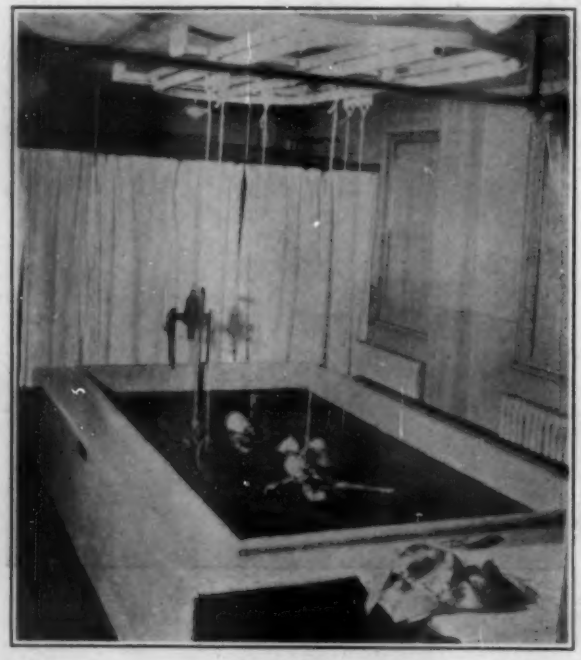
At present, infantile paralysis leads the list with frequency of cases being treated. Scoliosis, posture and dislocated hips rank next in frequency.

The accompanying pictures present some idea of the work being done.

Whirlpool for Leg.

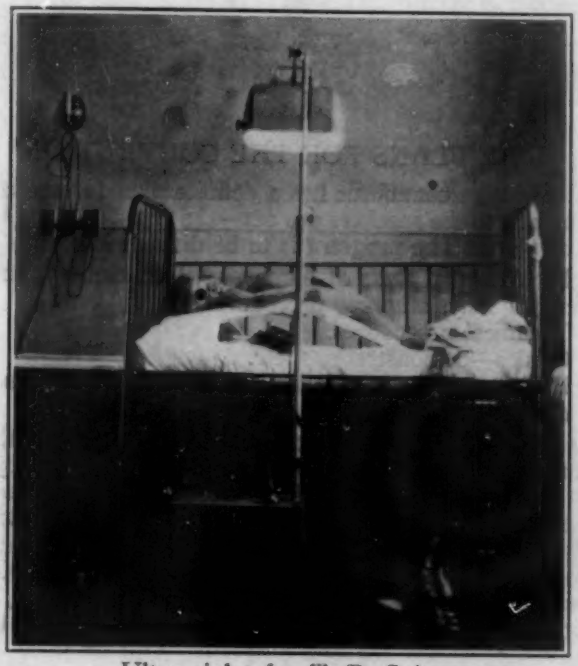


Whirlpool for Arm.



The Pool.

Infantile Paralysis Case with O. T. Work Done by Him.



Ultra-violet for T. B. Spine.

Extension Frame, Scoliosis Case.

"THE PLANS FOR THE CONVENTION"

The executive committee has a definite plan for the convention. The invitations to the speakers are out—the results are yet to be seen. This is the plan: The program is to be divided into

1. Fundamental facts of biophysics, biochemistry, and physiology underlying Physiotherapy procedures.
2. Technical procedures.
3. Clinics—demonstrations, etc.
4. Business of the association. Reports from officers. Reports from committees.

The first part of the program is an attempt to interest the medical profession to stimulate experimental work in Physiotherapy. To effect this Dr. Langley Porter, Dean of the Medical School of the University of California, our advisor and "big brother," wrote to the deans of every large medical school in the country. We had answers from Cornell, Northwestern University, Harvard, the Council of Physiotherapy of the A. M. A., Washington University, Columbia University, Stanford University and the University of California, with many suggestions for our program. Out of these letters we have invited two physiologists, two biophycists, a neurologist, a dermatologist and others to give us papers requesting that they touch on fundamentals rather than empirical treatment. We have also written to some member of the association in each city where the proposed speaker lives, in order to back up the invitation. If any one reading this knows of some outstanding person who might contribute to such a program, a harassed and hardworking executive committee would welcome suggestions with hearty thanks.

Dr. Ray Lyman Wilbur, President of Stanford University, and another of our advisors, has promised to open the meeting if he is in Portland, and though it isn't definite yet, he thinks he will be there.

The technical program as planned will be just amongst ourselves, a round table with invited physiotherapists to lead the discussions. Of course, all the members are expected to lend their experiences to this part of the program. The purpose of the leaders is just to lead. If you have case reports, X rays of interest, pet theories of technique, bring them with you. Here we will all be willing to listen and learn.

Miss Cora Howes, of the Portland Chapter, is in charge of the local program.

The business meeting is, of course, a part of the general plan. The committees will report and we have asked Miss Margaret Irvine of the educational committee to call together the heads of the schools

of Physiotherapy—the approved and the non approved schools—and have a little round-table amongst themselves.

Does this plan for a program interest you? Have you any criticisms? Have you suggestions for additions? To repeat, a willing, but busy executive committee, wants to serve you. This it can do best if it knows what you want. The review and convention are our backbone. Let's uphold it with its natural support—our members.

HAZEL E. FURSCOTT.

Headquarters for the convention are reserved at the Portland Masonic Temple, where most of the A. M. A. scientific assemblies are to be held.

The information about the hotels and railroad rates, printed in the Journal A. M. A. Jan. 5, p. 59, applies for members of the American Physiotherapy Association.

"ASSOCIATION NEWS"

THE PORTLAND SESSION

The local committee of arrangements for the Portland Session reports that requests for hotel reservations are being received from Fellows in all parts of the country, which indicates a widespread interest and a large prospective attendance at the session. Reservations have already been booked for Fellows in fifteen states. An experienced hotel man has been placed in charge of hotel arrangements, and definite assignments are being made to the various hotels. A printed "Hotel Reservation" form is being used which indicates the name of the hotel and the type of accommodation reserved. One copy of this form is sent to the one requesting a reservation and another copy is sent to the hotel.

The committee asks that those desiring reservations indicate the hotel of their choice, the type of accommodations desired, and, so that duplication may be avoided, the names of the persons who will occupy the rooms. *All requests for reservations should be addressed to Dr. E. A. Sommer, Electric Building, Portland, Ore.*

The rates quoted in the following list of Portland hotels and apartment hotels are for one or two persons in each room, unless otherwise indicated.

Portland Hotels

Name	Without Bath	With Bath
Adler		$5.00
Angela	$3.00	5.00
Arthur		5.00
Bellevue	2.00—3.00	
Benson		6.00—10.00
Bridgeport	2.00	3.00
Byron	3.00	5.00
Campbell		5.00
Campbell Court		5.00—6.00

	Without Bath	With Bath
Campbell Hill	3.00	4.00
Caples	4.00	7.00
Carlton		6.00
Carlyle	3.00	4.00
Carroll		3.50
Chamberlain	2.00	3.00
Clifford	2.00	3.00
Clyde		5.00
Commodore		5.00—6.00
Congress		6.00—7.00
Conradine		4.00
Cornelius	3.00	5.00
Eaton		4.00
Gordon		*5.00
Hamilton	2.00	*3.00
Heathman		6.00
Hillcrest	3.00	*4.00
Hoyt	3.00	6.00
Imperial	3.50	4.00—8.00
Lenox	3.00—4.00	5.00
Loraine		4.00
Mallory		5.00—7.00
Montana		3.00
Morris	3.00	5.00
Multnomah	3.50	4.00—8.00
Navarre	3.00—6.00	
Nortonia	3.00	5.00
Oregon	4.00	6.00—7.00
Palace		*5.00
Perkins	3.00	5.00
Portland	3.50—4.00	5.50—7.00
Prince of Wales		6.00
Ritz		5.00
Roosevelt		6.00
Rosaria		5.00
Roseland	3.00	5.00
Rowland	3.00	*4.00
Seward	3.00	4.00—5.00
St. Andrews		5.00
St. Francis	3.00	5.00
Sovereign		6.00—7.00
Treves	3.00	
Washington	3.00—4.00	*5.00—6.00
Y. M. C. A.	1.50 Single 2.00 Double	

Portland Apartment Hotels

Admiral (2 room)	5.00
Cromwell (2 and 3 room)	5.00—10.00
Doricourt (2 and 3 room)	4.00— 6.00
Empress	5.00
Lafayette	4.00— 5.00
San Carlos	5.00—10.00
Wheelden Annex (3 room connecting bath)	6.00
Wheelden Annex	3.00

*Connecting bath.

Railroad Rates to Portland

The Transcontinental Passenger Association has announced that before the time of the Portland Session the regular summer excursion fares, which are lower than the usual convention rates, will be in effect from all points east of and including El Paso, Tex.; Albuquerque, N. Mex.; Ogden and Salt Lake City, Utah, and the state of Montana.

It has also been announced by the Tariff Publishing Agent at San Francisco that the lowest fares available from points in California and from Reno, Nevada, will be the sixteen day summer excursion fares; from points in Arizona, fares for summer excursion tickets limited to Oct. 31, and from points in Nevada, east of Reno, passengers may purchase one month tickets to Reno and then sixteen day summer tickets to Portland, Ore.

The Pacific Northwest Convention Bureau has authorized the round trip rate of fare and one-half on the Identification Certificate Plan from points in Idaho, Washington and Oregon (except on the Southern Pacific) and from stations on the Great Northern in British Columbia. A member or fellow living in these states who expects to attend the annual session at Portland, Ore., is requested to write the American Medical Association for one of the identification certificates, which will entitle him and dependent members of his family to purchase a round trip ticket to Portland at a rate of one and one-half fares. The dates of sale of these tickets will be from July 4 to July 10, inclusive. The final return limit will be July 16.

The Southern Pacific Railroad Company announces that it will have in effect from all stations on its lines in Oregon round trip fares to Portland which are on a lower basis than on the identification certificate plan outlined.

You will note that the round trip rate of fare and one-half on identification certificate plan will not be needed EXCEPT FROM POINTS IN IDAHO, WASHINGTON, AND OREGON (except on S. P.). The regular summer excursion fares will be in effect and are lower than the usual convention rates.

Hotels (from list J. A. M. A. Jan. 5), which are nearest our convention headquarters, are:

	Without bath	With bath
Campbell Court		$5.00—6.00
Congress		6.00—7.00
Heathman		6.00
Portland	$3.50—4.00	5.00—7.00
Roosevelt		6.00
St. Andrews		5.00
St. Francis	3.00	5.00
Sovereign		6.00—7.00

The rates quoted are for one or two persons in each room.

Reservations in these hotels must be made through Dr. E. A. Sommer, chairman committee of arrangements, American Medical Association, 908 Electric Bldg., Portland, Ore. (see J. A. M. A. Jan. 5.). In making request include name and address of each person to occupy rooms and state member American Physiotherapy Association.

Make reservations early.

The convention committee recommends The Martha Washington Hotel, 380 Tenth St., Portland, Ore. Also near convention headquarters. Rates (American plan), without bath, $1.75; with bath connecting, $2.00.

Make reservation requests directly to the hotel.

Make reservations early.

Rainier National Park, Columbia River Highway, Yosemite Park, and other side trips may be arranged on round trip tickets. Ask your railroad agent.

TENTATIVE PROGRAM

EIGHTH ANNUAL CONVENTION OF THE AMERICAN PHYSIOTHERAPY ASSOCIATION, PORTLAND, ORE., JULY 8-11

Monday, July 8

3:00-6:00 p. m. Registration and informal tea at Portland Masonic Temple.
8:00 p. m. Address of Welcome.....Dr. Elmer C. Carlson

Tuesday, July 9

9:00 a. m. Business session.
12:00 noon. Officers conference and luncheon.
2:00 p. m. Clinic Shriners Hospital for Crippled Children.
8:00 p. m.

Wednesday, July 10

9:00 a. m. Business session.
2:00 p. m.
6:30 p. m. Banquet.

Thursday, July 11

9:00 a. m.—Clinic, Oregon State Industrial Accident Commission.
10:30 a. m. Posture Clinic, Helen Phillips.
2:00 p. m. Visit U. S. Veteran's Hospital, and Clinic at Doernbecker Memorial Hospital for Children.

CORA M. HOWES,

Chairman, Convention Committee, A. P. A., 725 Montgomery Drive, Portland, Ore.

CONVENTION COMMITTEE

CHAIRMAN—Miss Cora M. Howes, 725 Montgomery Drive, Portland, Ore.

Members-at-large—Mr. Lionel L. Wassell, 120 East 61st St., Portland, Ore.; Miss Virginia Shaw, Shriners' Hospital for Crippled Children, Portland, Ore.; Miss Miriam Ewing, 660 Knott St., Portland, Ore.; Miss Helen Phillips, 401 Central Bldg., Portland, Ore.; Miss Cora Davis, 1928 E. 90th St., Cleveland, Ohio; Miss Irma Walker, 7027 So. Park Ave., Chicago, Ill.; Miss Sara Kollman, 1003 Ivy St., St. Paul, Minn.; Miss Edna Griswold, 2287 University Ave., New York City; Miss Dorothy Hislop, 133 Waterman St., Providence, R. I.; Miss Helen Moore, 1801 Eye St., Washington, D. C.; Miss Gertrude Randle, U. S. Marine Hospital, No. 2, Chelsea, Mass.; Miss Katherine Roeschen, 6322 Woodland Ave., Fox Chase, Philadelphia; Miss Beulah Rader, 530 23rd Ave., San Francisco, Calif.

Attempting to follow California's good example, the Minnesota Chapter has established a local registry. They were advised by Dr. Meyerding to send their notice to the magazine of the Minnesota Medical Association rather than sending a letter to the various doctors as it would definitely show that the association was behind it. It was published in the January issue.

"REGISTRY FOR PHYSICAL THERAPISTS"

"The Minnesota Chapter of the American Physiotherapy Association, at the request of a number of physicians, is establishing a registry for women adequately trained in physical therapy.

"The names supplied through this registry are those of members of the American Physiotherapy Association, an organization recognized by the American Medical Association.

"The qualifications for active membership in the American Physiotherapy Association are one year's practice in physical therapy within two years graduation from:

(1) An approved school of physical therapy.

(2) An approved school of physical education and satisfactory completion of an approved course in physical therapy.

(3) An approved school of nursing and satisfactory completion of an approved course in physical therapy.

There is no charge for the services of the registry, the object of establishing it being to give the doctors throughout the state an opportunity of obtaining a trained physical therapist. The cooperation of the medical profession in using the registry will help to maintain the necessary standards in this branch of work. The present registrar is Miss Martha Hindman, 415 Hamm Building, St. Paul, Minn., Telephone Cedar 4581.

Application form for membership in the association may be obtained from the state secretary, Miss Ann Kelley, Mayo Clinic, Rochester, Minn."

Addresses are required for the following members: Lilly Leah Phillips, Anna, C. Halsteth, Gertrude Hatch, Irene Norcross.

The following interesting paragraph comes from Lembang, Java: "You will be glad to know that Physiotherapy has invaded this part of the world. A German physician in Batavia is using it quite extensively. In Bandoeng, a nearby mountain city, a Dutch physician has abandoned his general practice and for several years has devoted his entire time to light and electricity."

Miss Tougas is making a survey of the Physiotherapy Liability Insurance field. At the present writing information is most conspicuous by its absence. Anyone having such, is earnestly requested to get in touch with her at 9 Bellingham St., Newton Highlands, Mass.

ABSTRACTS

By JOHN S. COULTER, M. D.

Orthopedic Aftercare of Infantile Paralysis. By John C. Wilson, M.D., Los Angeles, Cal., in Southwestern Med., Vol. XII, No. 11, November, 1928, pages 505-6.

Under "Physical Therapy" Dr. Wilson says:

"Massage. The chief benefit from massage lies in the stimulation of the circulation. Mechanical emptying of engorged lymphatic spaces, with acceleration of the blood flow to and from the heart, will improve the nutrition of the tissues. To be effective, massage must be carefully carried out with a distinct objective in view. Too vigorous or rough manipulation is not to be permitted.

"Heat. Muscles respond more readily to exercise when the local temperature is increased. The character of the heat is immaterial. A greater amount of dry heat can be tolerated, consequently its use is more prevalent.

"Electricity. There is great difference of opinion in respect to the use of electricity. When it is impossible to obtain contractions by other means, the faradic current is useful. New paths for efferent impulses around damaged nerve centers may be developed by the application of the electrodes over motor points.

"Muscle Training. Muscle training has two distinct objectives: first, the development of new paths over which motor impulses may travel from the brain to the muscle end-plates, circumventing damaged nerve tissue; and, second, the development of weakened muscle fibres to a state of functional usefulness. It is well to move the extremity passivly through the arc of movement of the paralyzed muscle before an attempt is made to obtain a contraction. If the muscle does not have the power to carry the extremity through the full range of motion of the joint, it should be assisted. As muscle strength increases, the exercises are carried out against gravity and later with resistance.

"Clear and concise knowledge of the extent of the paralysis must precede the institution of muscle building. There is nothing more detrimental to the recovery of an extremity than harum-scarum exercises. A detailed discussion of the maneuvers for particular parts of the body is not essential. If the fundamental principles of muscle training are kept in mind, any necessary group of exercises can be worked out with the aid of a little knowledge of anatomy and muscle physiology.

"Under-Water Exercises. The tank or under-water gymnasium is being utilized with considerable success in the treatment of infantile paralysis. The warm water improves the circulation of the paralyzed muscles and the buoyancy of the water aids in active movements of the extremities. This sort of treatment is possible only in

institutions or in private swimming pools, in which water is heated. The importance of this type of exercise is so well recognized that a built-in tank has been added to the new Physical Therapy Department of the Los Angeles Children's Hospital. A tank should be a part of the equipment of any center where extensive treatment of poliomyelitis is carried out.

"Braces. Braces are applied to make walking possible, or to facilitate walking and prevent deformities. Braces have no beneficial effect upon the paralyzed muscles; the constriction required to secure them to the extremities impairs circulation and theoretically impeded repair. The benefits, however, derived from locomotion, counteract the untoward effects of fixation.

"Braces for the lower extremities and trunk are of importance in aiding locomotion. Instability of the knee, due to quadriceps femoris weakness is the chief condition requiring brace fixation. Patients may learn to walk without apparatus when quadriceps paralysis is present in one leg, by hyperextending and locking the knee. If the weakness is bilateral, braces are essential. The long caliper splints, with or without locks, are commonly used. Foot drop can be overcome by braces with ankle joints which do not allow motion of the foot below a right angle. The reverse is true in calcaneous deformities.

"Paralyzed trunk muscles are best supported by reinforced front-laced canvas corsets which extend from the trochanters to the axillae. The number and location of the steel ribs depend upon the extent of the paralysis.

"It may safely be said that any patient with two good arms can be taught to walk with crutches even though the lower extremities and trunk are severely paralyzed. The crutches form two legs of the tripod, and the paralyzed extremities the third. The patient may either swing the body forward between the crutches or hunch one crutch and leg forward alternately.

"Aeroplane splints are applied to the upper extremities to prevent deformities by holding weakened muscles in a position of relaxation; they are worn both night and day as long as required. Night splints are necessary to prevent undue muscular strain and deformities. Posterior wire splints are commonly used to prevent foot drop and knee flexion."

The Problem of Ankylosed or Partially Ankylosed Joints. By Charles F. Eikenbary, M.D., F. A. C. S., Seattle, Washington, in Northwest Med., Vol. XXVII, No. 12, December, 1928, page 575.

"Tuberculosis arthritis is not to be considered in this paper, for the reason that the result to be besired is always bony ankylosis in a good position. Suppurative arthritis or gonorrheal arthritis is likely to produce limited painful motion. To prevent this, some type of surgical treatment is urgently indicated. Certainly this is true in

the suppurative arthritis, and I am inclined to think the same thing is true in gonorrheal arthritis.

"The mild suppurative arthritis, due to staphylococcus albus, very frequently may be speedily controlled by aspiration and absolute rest. Following this, when the disease is a thing of the past, gradual motion—never under an anesthetic—will restore the joint to normal.

"The innumerable forms of nonsuppurative arthritis have a tendency to lead to limited motion, usually painful, or to no motion, usually not painful. Naturally, the first step in the preservation of useful motion is to eliminate the cause.

"I know of no mysterious light or electrical current that will dissolve adhesions, or that has any appreciable effect upon cases of this sort. The adhesions must stretch and stretch gradually, or they must be broken without enough force to produce hemorrhage and, therefore, more adhesions. To produce motion forcibly, under an anesthetic, is without doubt the worst thing that could be done with such a joint.

"Whether or not to do an arthroplasty must depend upon the condition of the other joints. In the joint with a limited motion, following the fracture into a joint, we have the same indications for restoration of motion that we have in the arthritic cases and for the same reason. To apply force sufficient to justify anesthetic in order to break up adhesions can only mean injury to the capsule, hemorrhage from the capsule and from the adhesions, increased pain, and a greater number of adhesions, denser than the ones that you have just broken up. I know of no better way to defeat your purpose than the use of the very procedure I have just condemned. Passive and active motion, plus a force that stops short of severe pain, will give you far better results than you may ever hope to attain by applying force under an anesthetic.

"There is a fallacy that runs through medical practice, but not through medical literature, that motion in the involved joint may be restored by forcibly bending the same, under full anesthesia. What happens when this procedure is carried out in the case of a knee, for example? The most favorable thing is that the muscles may stretch sufficiently so that flexion of the knee may be produced. The likely thing is that the muscles and fascia, and possibly the capsule, may be torn in various places, which completely defeats the purpose of the procedure. Tearing of the muscles necessarily means more fibrosis, more adhesions, and a knee that is more limited in its motion than it was before. The unfortunate result is all too frequently a refracturing of the femur or a fracturing of the patella. I personally know of ten cases of fracture of the femur, from this procedure, three cases of fracture of the patella, and one case of sudden death from pulmonary embolism. The procedure is unsound physiologically and mechanically and should be relegated to the scrap heap.

Given an elbow markedly contracted from extensive burns at the bend of the elbow, would any surgeon attempt to restore that elbow to normal by forcibly tearing the scar to pieces under an anesthetic? And yet such a procedure seems to me to be no less absurd than that of applying great force under an anesthetic, in an attempt to restore the partially ankylosed joint. Gradual motion, active and passive, force that stops short of severe pain, these will give you a good result, whenever it is possible for a good result to be obtained.

SUMMARY

"The chief object of this paper is to bring before you for condemnation, a surgical procedure that is quite common and which is unsound in every way, in my opinion."

The Personnel of a Successful Physical Therapy Department. By Gertrude Beard, R.N., Director of Physical Therapy Department, Wesley Memorial Hospital, Chicago, Ill., Instructor in Physical Therapy, Northwestern Medical School, in Hospital Progress, Vol. IX, No. 11, November, 1928, page 463.

"The proper location, a correct plan, and mechanically perfect apparatus, are all necessary and important in establishing a physical therapy department in a hospital, but all are useless unless the department is administered by efficient personnel.

"The executive committee of the American Physiotherapy Association has during the past year prepared an outline for those schools giving an approved course in physical therapy of a curriculum which they believe is possible to develop within a few years, with the intention of making this a minimum requirement for approved schools.

"The department cannot be made a success if too much apparent economy is practiced in the matter of salaries. Nurses who have spent their time and money for this additional education cannot afford to be under the greater physical as well as the mental strain of treating many patients one directly following the other throughout the day, even though the hours of employment may be shorter, at the same salary obtained for nursing."

Status of Premature Alopecia. By Jacob Spitz, M.D., Boston, Mass., in Urol. & Cutan. Rev., 32, No. 11, November, 1928, page 755.

This author says in part: "The ultraviolet ray is useful, provided that there has been sufficient loss of hair to favor the access of the rays to the scalp. If the hairs obstruct the rays, this treatment is of little or no value. Diathermy is, in my opinion, of great value in the treatment of this condition, in which it acts as a stimulant."

Electrical Treatment by Osteopath Unlawful. (State Board of Medical Examiners of New Jersey v. DeYoung (N. J.) 140 A.

676.) In Medicolegal Section, Journal A. M. A., Vol. 91, No. 21, Nov. 24, 1928, page 1657:

"The defendant, a licensed osteopath, displayed various signs: 'Electric Treatments,' 'Doctor De Young' and 'Dr. De Young's Health Office.' A witness testified that he prescribed for her a diet, advised her to take rhubarb and soda, examined her by means of a fluoroscope, and caused electrical treatments to be given her by a nurse under his direction. Four other witnesses testified to the same effect. Prosecution was instituted by a member of the State Board of Medical Examiners. The trial court dismissed the complaint on the ground that the defendant was licensed to practice osteopathy and therefore had a right to give electrical treatments. By a writ of certiorari, the State Board of Medical Examiners carried the case before the supreme court of New Jersey. The defendant contended that one who obtains a license to practice osteopathy has, by the terms of the law, studied such subjects as would qualify him to give electrical treatments. The court suggested, however, that while this argument was persuasive as to why osteopaths should by law be permitted to give electrical treatments, it was unsound as to their having, under the statutes now in force pertaining to the practice of osteopathy, the legal right to do so. Under the law the osteopath is now limited in his treatment to the manipulation of the human body by hand, so as to bring all parts into proper position. The court held, therefore, that an osteopath who gives electrical treatments in New Jersey violates the medical practice act of that state. There was evidence that the defendant used the letters 'Dr.' in connection with his name, without qualifying the meaning of that designation. Section 8 of the medical practice act of New Jersey provides that any person is regarded as practicing medicine and surgery who uses the letters 'Dr.' in connection with his name and holds himself out as being able to diagnose, treat, operate or prescribe for any human disease, pain, injury, deformity or physical condition. The supreme court held that the testimony with respect to this feature of the case seemed to warrant a conviction, since the defendant did use the letters 'Dr.' in connection with his name and did offer and undertake by a method to treat a physical condition. The judgment of the trial court was reversed."

THE STUDY OF PHYSIOTHERAPY AS A VOCATION

By LUCILE R. GRUNEWALD

CHAPTER V

PRESENTATION AND INTERPRETATION OF DATA BASED ON OBJECTION III: TO DETERMINE WHERE THE TRAINING IN PHYSIOTHERAPY CAN BEST BE OFFERED AND THE LENGTH AND CONTENT OF A SUITABLE COURSE

To determine where the training of Physiotherapy can best be offered is the problem of first consideration. The place of training determines to a great extent the length and content of course. The training may be offered (1) in a special school of Physiotherapy with only a high school education as a prerequisite; (2) in a special school of Physiotherapy with training in nursing or physical education as a prerequisite; (3) in a special school of Physiotherapy with a general college education as a prerequisite; (4) in a university with Physiotherapy as a major or (5) in a university in a department of physical education with a specialization in Physiotherapy. The length and content in each case would differ.

Table VI, on the following page, gives a compilation of the opinions of seventy-six physiotherapists regarding the place where the training in Physiotherapy can best be offered. Many of the physiotherapists gave several choices in places.

TABLE VI—SHOWING THE OPINIONS OF SEVENTY-SIX PHYSIOTHERAPISTS ON WHERE THE TRAINING IN PHYSIOTHERAPY IS BEST ORDERED

Hospital training school	5
Major in Physiotherapy in university	21
Medical school	3
Nurse's training school	3
Nurse's training plus a Physiotherapy course	2
Physical education department in university (with opportunity for specialization)	27
Physical education school (with opportunity for specialization)	27
Physical education training plus a special Physiotherapy course	10
Special school of Physiotherapy (only)	5

(Note—There are more than seventy-six opinions, some individuals having stated more than one.)

Table VI indicated that the training in Physiotherapy can best be offered either in a physical education school or a department of physical education in a university, both of which give an opportunity for specialization; or in a university that offers a Physiotherapy major.

Some of the physiotherapists felt so strongly on the question of where the training should be given that at the end of the questionnaire where suggestions might be added they again stated their opinions on this subject. The following suggestions were made:

Profession should be on a high plane. Courses should be given with other university work leading to a degree of Bachelor of Science.

I would like to see Physiotherapy given as a major course in a university, leading to a Bachelor of Arts Degree, because of the better language requirements. French and German, at least, should be understood.

In a course given in a university, it is very important to have clinical experience under the direction of physicians and surgeons.

Requirements should be rigid. All special training should preferably be given by or under the direction of a medical school.

There should be a university course with a Physiotherapy major and leading to a Bachelor of Science Degree.

A number of physiotherapists accompanied their questionnaires with letters, giving their opinions on the subject of the place and content of a course in Physiotherapy. One thought that the training of physiotherapists was at the present time in a deplorable state ". . . not a single school in the East is offering a *full* course in Physiotherapy. In order to cover the ground at present it is necessary to take course upon course in various schools. Work in a number of schools wastes the student's time in unnecessary things." She suggests a major course in Physiotherapy in a university affiliated with a hospital or clinic where practical experience in all branches of Physiotherapy may be had.

Two former instructors of reconstruction aides wrote that the course in Physiotherapy should be based on a strong course in physical education, preferably given in a state university.

"I am in thorough sympathy," says another physiotherapist, "with the idea of making this particular profession a major course in a university. We cannot be too well prepared for this sort of work. The orthopedic surgeons are making strides themselves and we, who do their follow-up work, must keep pace."

Some of the opinions of the physicians on this subject were as follows: One of the orthopedic surgeons preferred a physiotherapist with nurse's training. Another suggested a general university course with opportunity to specialize in Physiotherapy. One extremist, a leading orthopedic surgeon in southern California, submitted to the writer an outline of a suggested five-year course which he has worked out and would like offered as a major course in a university. In speaking of assistants to orthopedic surgeons in Physiotherapy departments, he writes, "I am well aware of the fact that some persons in high positions educationally do not agree that it should be a function of the physical education department of a university to attempt the teaching of specialized corrective work. However, unless the university and recognized schools of physical education change the character and type of their teaching so as to graduate competent and accredited students who have the weight of a university degree back of their training, we shall still find the large field of which I have

spoken filled with untrained and unqualified persons, many of whom are little more than incompetent charlatans. . . . Some hold that medical institutions should take over teaching of this kind. Granted! But medical students are not the ones who will practice in this field. Consequently the task falls to the lot of the physical education students."[1]

On the other hand, a prominent physician who is a specialist in physical therapy (chiefly electro-therapy) feels very strongly opposed to having his assistants trained in Physiotherapy in any school He writes "Under no conditions does a nurse require training in the practice of physical therapy except under the direction of a physician who understands the work himself. What is needed today is a training of the medical profession in order that they may train their own nurses to operate with them in their offices and carry out their own ideas and methods in the light of their own understanding, and under no conditions entrust humanity to those who have not had medical training."

Another physician, a leader in physical therapy, writes that he feels "the best preparation is graduating from a college, majoring in the sciences offered in physical education, or nursing, followed by one year of intensive work wholly in the field of medicine."

The consensus of opinion of a group of physiotherapists at a meeting of the Southern California Physiotherapy Association, attended by the writer, was that the training of Physiotherapy should be in a university. In both New York University and Boston University there is an opportunity to major in Physiotherapy in the department of physical education in the school of education. Applicants for the course in Physiotherapy aide training in the United States army must be graduates of accredited schools of physical education.

One might conclude from the answers to the questionnaires and from the letters from physiotherapists, and from physicians and surgeons who are engaging assistants in physical therapy, and from courses offered in Physiotherapy, that the place where Physiotherapy can best be offered is in a school of physical education or a department of physical education in a university with an opportunity for a specialization or in a university with a Physiotherapy major.

As to the length of the course in Physiotherapy, there are also many opinions. In reply to the question, "If the training of Physiotherapy aides were standardized would the demand warrant a four or five-year university course?" only two of the sixteen physicians believed the demand would warrant as long a course. One said, "It would seem possibly too high a standard to be practical, unless you mean an ordinary college course with proper major subjects supplemented by a year of postgraduate study."

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[1]Lowman, M. D., Charles L. "Present Day Problems in Physical Education." *American Physical Education Review*. October, 1921. p. 315.

In an article, "Educational Requirements of the President and Future in Physiotherapy," Dr. Stewart says, "To find a parallel to the growth in the range and scope of Physiotherapy during the last decade, one must turn back to the development of medicine itself which occurred within the last half century. The time was, within the memory of our parents, when a physician could qualify for practice by reading medicine in the office of an elder physician for a period of two years. Courses within the medical schools were not uniformly of four years in length until nearly the last of the preceding century. Later for proper scientific background; first, high school graduation; then, one or two years of college; and, in many instances, college graduation was demanded. After graduation the value of hospital experience became more and more impressed upon those responsible for medical education, so that not only are one or two years of internship required before taking the state board examination, but some schools do not grant medical degrees until after such experience. Such we see the years devoted to the study of the healing art have increased from a minimum of two to a maximum of ten, in order that a usable amount of the vast accumulation of knowledge in the field of medicine could be grasped by the student.

"In the field of Physiotherapy a similar situation has arisen. Courses of from four to six weeks were the rule just before, during and immediately after the war. In the New Haven School, the course of technicians was four weeks up to 1920; six weeks in 1921; two months of double sessions to 1925; one school year from then on, with an optional post-graduate year offered for 1927-1928."[2]

On the following page is tabulated the replies of sixty-eight physiotherapists to the question, "In a standardized course in Physiotherapy, how many years beyond high school are desirable?"

TABLE VII—SHOWING THE OPINIONS OF SIXTY-EIGHT PHYSIOTHERAPISTS ON THE NUMBER OF YEARS BEYOND HIGH SCHOOL DESIRABLE FOR A STANDARDIZED COURSE IN PHYSIOTHERAPY

Number desiring two years	10
Number desiring three years	21
Number desiring four years	31
Number desiring five years	6

This table indicates that the majority of physiotherapists desire at least four years of training beyond the high school.

The number of years of experience in Physiotherapy practice, in a consideration of the tenure of office of the physiotherapist, justifies a four year college course in preparation for this practice. Ten physiotherapists have had more than fifteen years experience; twenty-four, more than ten years; forty-five, more than five years experience.

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[2]Stewart, Harry Eaton. "Educational Requirements of the Present and Future in Physiotherapy." *The Physiotherapy Review.* September, 1927.

[3]Stewart, Harry Eaton. "Education Requirements of the Present and Future in Physiotherapy." *The Physiotherapy Review.* September, 1927, p. 3.

The salaries also warrant a four year course in preparation. Of the fifty-five stating salaries, forty-eight received $1,800.00 or more and twenty-five received $2,400.00 or more. The salaries ranged from $1,500.00 to $5,500.00 per year. These salares are comparable with the salaries of high school teachers in most cities. Most city high school teachers are required to have at least four, and many five, years of college training.

In answer to the question, "In what ways has your training been insufficient in your practice of Physiotherapy?", fifty felt their training was insufficient in one way or another and several stated a desire for an opportunity to take university extension courses in Physiotherapy. This seems to indicate that their training was inadequate and not long enough for a thorough course.

The Civil Service Commissions and the states licensing physiotherapists require the applicants to be twenty-one years of age and in some cases twenty-two. College graduates are usually twenty-one or twenty-two years of age. A four-year college course, specializing in Physiotherapy would allow the time preceding this required age of Civil Service Commission to be well spent.

One physiotherapist stated that a four year college course is not any too long because a person practicing Physiotherapy needs mature judgment. The physiotherapist also needs vision, imagination and and other qualities which come only with time and a liberal education. There is a danger of beginning specialization while too young. The University of Oregon in a pamphlet, "The Lasting Appeal of a Liberal Education," in speaking of the training in the liberal arts college, says its chief value to the increasing number of university students is to fit men and women for a fuller life. "The specialization so characteristic of modern life, although it contributes immensely to the efficiency of men, has a tendency to stifle interest in the broader aspects of life and to limit vision. The man of affairs will continue to live worthily and well only when his apprenticeship in a chosen vocation has been preceded by liberalizing influences that have become habitual. If, through the study of literature and art, imagination has been quickened and an appreciation of creative genius implanted, he will see, in spite of sordid eye and the unresponsive soul." [4] This is especially important to the physiotherapist who is always dealing with the abnormal. If a generous admixture of literature and social sciences are necessary to humanize a doctor they are also necessary for a physiotherapist.

In considering, therefore, the content of a course in Physiotherapy, not only the special subjects should be given place in the curriculum, but also literature, social sciences and languages. Granted that this is so, the course of study of the fundamental subjects, such as anatomy and physiology, and the special physiotherapy subjects,

[4]College of Literature, Science and the Arts—University of Oregon. *The Lasting Appeal of a Liberal Education.* p. 9.

such as electro-therapy and therapeutic exercise, may be considered in detail.

A compilation of the answers to the question, "What subjects are most essential in a course in physiotherapy?", will be found in Table VIII on the following page.

TABLE VIII—SUBJECTS CONSIDERED ESSENTIAL IN A COURSE IN PHYSIOTHERAPY BY SEVENTY-SIX PHYSIOTHERAPISTS

Name of Subject	*Number of Physiotherapists Who Thought Course Essential*
Fundamental Subjects in Science	
Anatomy	67
Physiology	54
Psychology	35
Physics	33
Chemistry	30
Bacteriology	19
Biology	8
Neurology	6
Physiotherapy Subjects	
Applied anatomy (Kinesiology)	47
Massage	35
Therapeutic exercise (Medical gymnastics)	27
Electro-Therapy	27
Pathology	25
Hydrotherapy	18
Muscle re-education	10
Orthopedics	10
Electro-Physics	7
Heliotherapy	5

In reply to the question, "In all your training, what courses have been most valuable to you in your practice of physiotherapy?", forty-five said, anatomy; thirty-eight, applied anatomy (kinesiology); twenty-three, physiology; twenty-one, massage and thirteen, therapeutic gymnastics. In reply to the question, "In what ways has your training been insufficient in your practice of physiotherapy?", nineteen said, electro-therapy (including electro-physics); ten, pathology and nine, physiology (including neurology). As most of the physiotherapists are physical education graduates one might infer from these replies that, in their physical education training, their courses in anatomy, applied anatomy, physiology, massage and therapeutic exercise were satisfactory, but that, in electro-therapy, pathology and neurology, the courses were insufficient or entirely lacking.

In Table IX, on page 66 will be found the results of a survey of the foundation sciences listed in the various bulletins of schools of nursing which offer a five-year curriculum. From this survey one might infer that the instruction in anatomy is too limited for adequate training in physiotherapy. Applied anatomy and therapeutic exercise are not offered. Courses in chemistry seem longer than necessary.

In order to understand the mechanics of movement and electro-therapy, physics should be given a place in the curriculum. Physiology of exercise should follow a course in physiology. In many of the three-year courses for nurses the fundamental subjects are given on a part time basis with ward duty under conditions which are unfavorable for thorough study. These courses are often taken after a full day on duty when the students are fatigued and incapable of concentration.

TABLE IX—RESULTS OF A SURVEY OF FUNDAMENTAL SCIENCES AS LISTED IN BULLETINS OF SCHOOLS OF NURSING WITH A FIVE YEAR CURRICULUM

Name of University	*Fundamental Sciences*			
	Anatomy No. of Units	Physiology No. of Units	Chemistry No. of Units	Physics No. of Units
University of California	3	5	10	0
University of Iowa	2	3	4	0
University of Michigan	3	3	16	8
University of Oregon	0	4	8	0
University of Washington	6¾	7½	7½	7½
University of Wisconsin	0	6	5	0
Teachers College, Columbia University	2	4	8	0
Yale School of Nursing	2	2	2	0

In schools of Physiotherapy with a prerequisite of a nurses training or physical education training or a general college training, it might be difficult to develop a satisfactory curriculum in Physiotherapy with the varied background of education in the fundamental subjects. Some of the students in such a school have had chemistry, physics, physiology and anatomy while others may have had several or none of them. To build a course in Physiotherapy on such a foundation seems most inadequate. These fundamental subjects should be taken in sequence such as chemistry, physics, biology, anatomy, applied anatomy, physiology, physiology of exercise, pathology, etc. In order to be taken in sequence it means two or three years time. It might be better for these schools to make a prerequisite of these subjects. Schools of nursing and physical education require many subjects or more time in various subjects that are not essential in a school of Physiotherapy.

"A curriculum, to be adequate at present, must include more time devoted to anatomy, physiology, and theory and practice of all phases of Physiotherapy, than a short course could possibly include.

"The special advantage, which the present student in a high grade school receives, is the increased knowledge which comes from sufficient time devoted to the fundamental branches underlying our work. Biology, embryology, physics, chemistry and especially modern electro-physics are prime essentials. Then the proper understanding of the clinical application of physical measures requires that the student take courses which will provide a background of clinical knowledge in medicine, surgery, orthopedics, gynecology, neurology,

gastroenterology and the various other specialties into whose field the use of Physiotherapy is rapidly gaining headway.

"Exception might be taken to this point of view: The writer had repeatedly heard it stated that the technician need only be taught the management of apparatus; the rest belongs to the physician. One might as well say, the nurse needs only to know how to make up a bed and bathe a patient. Most of us would not care for the services of one whose thirst for knowledge and scientific interest could be satisfied by learning to turn on and off a few machine switches and apply electrodes to a patient. One of the greatest joys in work is to have a thorough understanding of an intricate and varied subject. This is enhanced by one's ability to take as large a part as possible in such an important branch of human endeavor as is the treatment of patients.

"The fact that occasionally an individual may assume too much of the responsibility that properly belongs to the physician is no argument against the general principle advanced; namely that the more intelligent and more thoroughly educated the Physiotherapy technician is, the more efficiently will she do her work, and the greater will be her interest and love of it. . . .

"The higher the educational standard for this work, the greater is the challenge to the right type of individuals and the more thoroughly will they be prepared for the high calling of Physiotherapy technicians, a field that is most rich in both service and reward."[6]

The American Physiotherapy Association has a suggested curriculum as a minimum standard for schools of physical therapy—

Length of Course
9 months including 1200 hours, 33 hours per week.

Entrance Requirements
Graduates of recognized schools of Physical Education, or
Graduates of recognized Schools of Nursing.

Subjects to be Taught by Members of the Medical Profession
Anatomy
Physiology
Surgical observation
Orthopedics
Pathology

Major Subjects	*Theory*	*Practice*	*Total*
Anatomy			300
Physiology	36	36	72
Orthopedics	36	36	72
Muscle training	36	72	108
Corrective exercise	36	72	108
Massage	18	72	90
Electrotherapy	18	54	72
Minor Subjects			
Pathology	36		36

[6]Stewart, M. D., Harry Eaton. "Educational Requirements of the Present and Future in Physiotherapy." *The Physiotherapy Review.* September, 1927, pp. 3-4-5.

Surgical observation		36	36
Principles of apparatus	6		6
Chemistry	27	54	81
Physics	27	54	81
Kinesiology	36		36
Ethics	6		6
Psychology	18		18
Light therapy	18	27	45
Hydrotherapy	6	18	24
Mechanotherapy		6	6
Thermotherapy	1	2	3

In the course in Physiotherapy at New York University, in the junior and senior years twenty-eight points are taken in physical therapy at the hospital for the Ruptured and Crippled Children and thirty-six points in the School of Education. The thirty-six points in the School of Education are as follows:

	Points
Practice teaching	2
Physiology	8
Psychological foundation of method	2
Special methods in physical eduction	2
General kinesiology	2
Physical achievement tests	2
History of education	4
Physiology of activity	2
Educational psychology	4
Educational sociology	4
Adaptation of activities in corrective procedures	2
Physical examination	2
	36

The twenty-eight points in physical therapy will include the following subjects:

1. Applied anatomy
2. Pathology
3. Orthopedics
4. Arthritis
5. Gynecology
6. Neurology
7. First aid
8. Ethics
9. Electrotherapy
   a. Galvanism
   b. Faradism
   c. Sine and wave currents
   d. High frequency currents
   e. Static or frictional electricity
10. Thermotherapy
11. Phototherapy
12. Hydrotherapy

13. Massage
14. Therapeutic exercises

Judging from the above curricula and from curricula of other schools offering specialization in Physiotherapy; and from the state requirements, as well as from the answers to questionnaires on required subjects, the following courses can be classed as essential:

Major Courses	*Minor Courses*
Anatomy	Chemistry
Physiology	Physics
Physiology of exercise	Psychology
Electro-therapy	Pathology
Massage	Ethics
Muscle training	Hydrotherapy
Orthopedics	Mechanotherapy
Therapeutic exercise	Phototherapy
	Thermotherapy
	Surgical observation

One concludes from this data in this chapter that a suitable curriculum can best be offered in a university in a four-year degree course with the above essential subjects included:

PARTIAL INDEX TO CURRENT LITERATURE ON PHYSICAL THERAPY

Adequate Play for Crippled Children. MARIE M. READY, Crp. Child, Feb., p. 133.

Behavior Difficulties in Children Associated with Birth Trauma. P. L. SCHROEDER, M. D., Jour. A. M. A., Jan. 12, p. 100.

Breaking of Viscious Cycles by Remedial Exercise. JAMIESON B. HURRY, M. A., M. D. and ALLISON W. CAMERON, M. D., M. B., Jour. Chart. Soc. Mass. Med. Gym., Dec., p. 125; January, p. 151.

Council on Physical Therapy. Jour. A. M. A., Dec. 8, p. 1803; Jan. 5, p. 54.

Dosage in Heliotherapy; A Plea for Laboratory Control. J. ROSSLYN EARP, Dr. P. H. Jour. A. M. A., Jan. 26, p. 316.

Duluth's Class for Handicapped Children. MRS. ARTHUR P. BARNES, Crip. Child, February, p. 121.

Erythema Sunshine Hours Chemically Determined. (Currect Comment) Jour. A. M. A., Jan. 26, p. 317.

Infantile Paralysis in Massachusetts. ARTHUR T. LEGG, M. D. Jour. A. M. A. Jan. 5, p. 31.

Intracranial Birth Injuries. HUGO EHRENFEST, M. D. Jour. A. M. A., Jan. 12, p. 97.

Low Voltage Currents in General Practice. C. M. WESTERMAN, M. D., Amer. Jour. P. T., February, p. 497.

"Margaret Morris" Movement. MARGARET MORRIS, Crip. Child, December, p. 93.

Mental Hygiene for Crippled Children. FRANCIS E. SHIRLEY. Crip. Child, December, p. 105.

Michael J. Dowling School for Crippled Children. OLGA L. LOMMEN, Crip. Child, February, p. 119.

Minnesota Association for Crippled Children. OSCAR M. SULLIVAN, Crip. Child, February, p. 115.

Modern Carbon Arc Therapy. (A summary) Amer. Jour. P. T., January, p. 454.

Notes of a Lecture on Singing Physicals. MME. CLARA NOVELLO DAVIES. Jour. Chart. Soc. Mass. Med. Gym., January, p. 155.

Notes on the Measurement of Ultra-Violet Radiation. R. B. BOURDILLON, M. A. B. M., B. Ch. Amer. Jour. P. T., February, p. 515.

Operative Fusion for Tuberculosis of the Spine. MELVIN S. HENDERSON, M. D. Jour. A. M. A., Jan. 5, p. 54.

Physical Therapy and the General Practitioner. J. T. SCOTT, M. D., Amer. Jour. P. T., January, p. 451.

Pioneers of Orthopaedics. ARTHUR ROCYN JONES, B. S., F. R. C. S., Crip. Child, December, p. 104; February, p. 138.

Psychology of the Crippled Child. J. E. RAMSDEN, B. A., Crip. Child, February, p. 123.

Quartz Lamp Therapy in Human Rickets and Rachitic Spasmophilia; Efficacy of Single Weekly Exposures. HENRY J. GERSTENBERGER, M. D. and J. J. HARTMAN, M. D., Jour. A. M. A., Feb. 2, p. 367.

Romance in Scissors. VIVIAN M. HACKETT, Crip. Child, February, p. 129.

Scout Training for Crippled Boys. JAMES E. WEST, Crip. Child, December, p. 91.

Social Aspects of Orthopaedic Surgery. CHARLES LEROY LOWMAN, M. D., Crip. Child, December, p. 87.

Specificity of Vital Ultra-Violet Radiation. HERMAN GOODMAN, B. S., M. D.; Amer. Jour. P. T., February, p. 519.

State Care of Crippled Children at Gillette State Hospital. ELIZABETH MCGREGGOR, Crip. Child, February, p. 117.

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